State Route 89A

State Route 89 to Robert Road Transportation Study

Working Paper 2

December 2017

CYMPO
Central Yavapai Metropolitan Planning Organization

ADOT

AECOM

Task Assignment: MPD0047-17

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List of Abbreviations

AADT	Average Annual Daily Traffic
ADOT	Arizona Department of Transportation
Appr.	Approach
CYMPO	Central Yavapai Metropolitan Planning Organization
DDI	Diverging Diamond Interchange
Dr	Drive
EB	Eastbound
HSIP	Highway Safety Improvement Program
LOS	Level of Service
MPD	Multimodal Planning Division
NB	Northbound
Pkwy	Parkway
Rd	Road
RSA	Roadway Safety Assessment
ROW	Right-of-Way
RTP	Regional Transportation Plan
SB	Southbound
SR	State Route
TI	Traffic Interchange
WB	Westbound
FY	Fiscal Year

1.0 Introduction

The Arizona Department of Transportation (ADOT), Central Yavapai Metropolitan Planning Organization (CYMPO), and Yavapai County contributed funding towards the State Route 89A – State Route 89 to Robert Road Transportation Study. The City of Prescott and Towns of Prescott Valley, Dewey-Humboldt, and Chino Valley are experiencing increased traffic volumes due to general growth, commuter, commercial, and recreational traffic. In an effort to plan for both current and future traffic impacts in the area, a planning study is beneficial in addressing capacity, access, safety, and operational efficiency on State Route (SR) 89A from the SR 89 Traffic Interchange (TI) to east of Robert Road.

1.1 Study Area

The study area for the SR 89A Transportation Study encompasses SR 89A from the SR 89 traffic interchange at milepost 317.3 to east of the Robert Road intersection at milepost 325.0 on Fain Road. The study area is shown in **Figure 1**.

The corridor limits include one (1) signalized intersection at Robert Road, where SR 89A continues northeast to Jerome (not included in the study limits) and Fain Road begins east of the intersection, connecting SR 89A to SR 69. Additionally, the study corridor includes five grade separated traffic interchanges (at Viewpoint Drive, Glassford Hill Road, Granite Dells Parkway, Larry Caldwell Drive, and SR 89) and one (1) un-signalized roadway connection approximately 1.25 miles west of Glassford Hill Road. The entire length of the study corridor is a four-lane divided freeway facility.

1.2 Purpose and Needs

New housing developments are underway at the Granite Dells Parkway TI, west of Glassford Hill Road (south of SR 89A), and other areas to the west of the study limits have been rezoned for commercial use. Additionally, the City of Prescott has approved the final plat for the Walden Ranch development (Phases 1A, 1B, and 2) at Larry Caldwell Drive. These factors are anticipated to escalate the congestion concerns and may contribute towards the increase in safety needs along the study corridor.

The Average Annual Daily Traffic (AADT) within the corridor is approximately 26,000 (2014), which (prior to the aforementioned developments) has experienced an 8% per year increase in traffic volumes in recent years. Additional regional capacity needs have been identified in the CYMPO 2040 Regional Transportation Plan (RTP) Update, within ADOT's 2013 Corridor Location Study and Environmental Overview: I-17 to Fain Road Connector (ADOT Project # H8162), and Yavapai County's Great Western Feasibility Study.

224 total crashes have occurred over the 5 years period between 2011 and 2015, throughout the study corridor. Seven (7) of these crashes were incapacitating and three (3) were fatal incidents. All three of the fatal incidents occurred at the Robert Road intersection on the eastern terminus of the study corridor. In 2015, ADOT performed a Roadway Safety Assessment (RSA) at this location.

1.3 Study Goals & Objectives

The primary objectives of the study are to: 1) identify the expansion needs for the corridor; 2) prioritize the needs for the short (5-year), mid (10-year), and long-term (20-year) planning horizons; and 3) scope out and prepare 15% design plans for the recommended solutions.

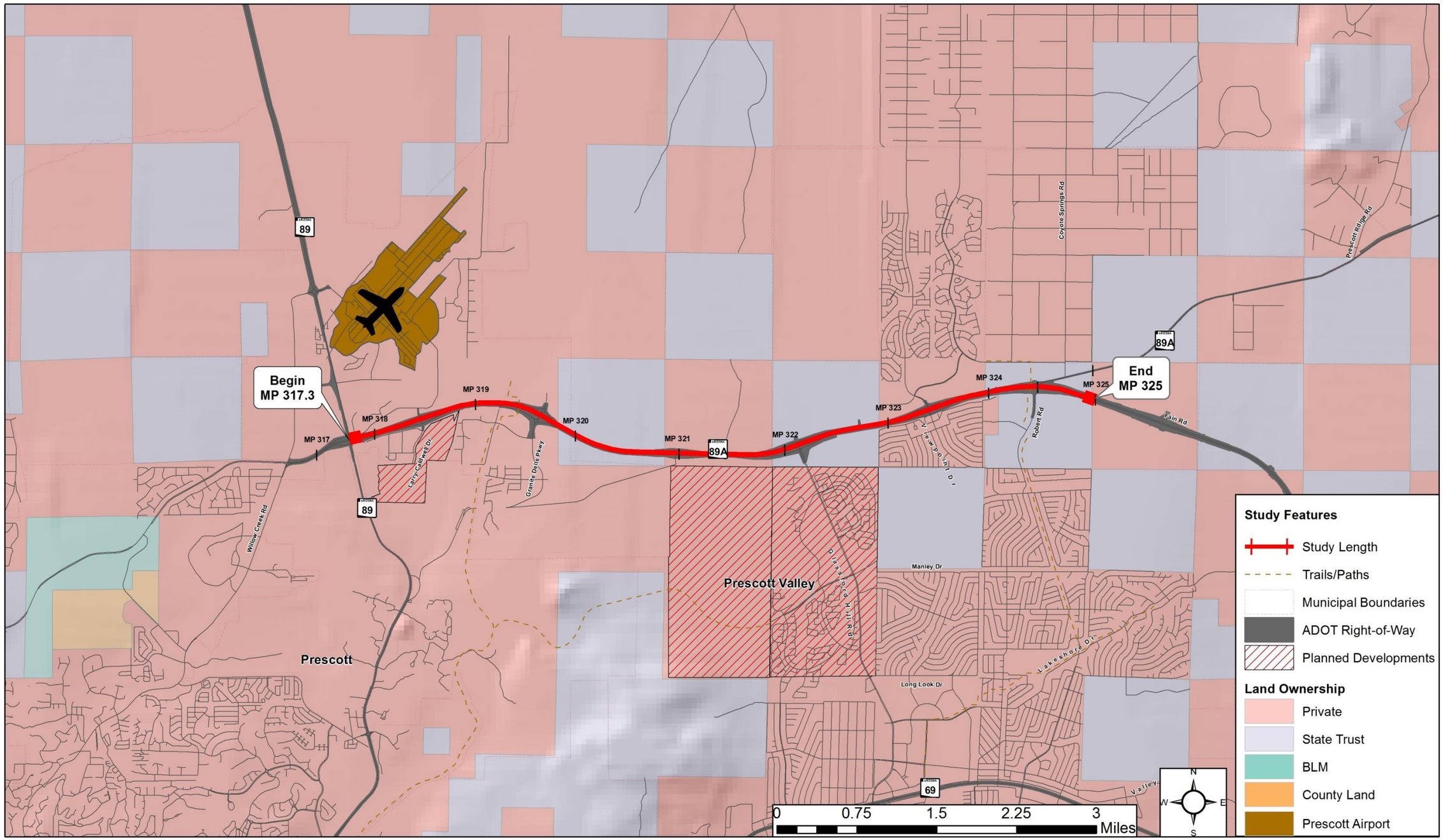
1.4 Study Process

This study is scheduled to be conducted within a 12 month timeframe. A Core Study Team has been established, representing ADOT Multi-modal Planning Division (MPD), ADOT Northwest District, CYMPO, Yavapai County, City of Prescott, and Town of Prescott Valley officials to closely coordinate throughout the development of the study deliverables.

Additionally a Stakeholder Team has been established including the Study Team agencies as well as representatives from the Town of Chino Valley, Town of Dewey Humboldt, Fish and Wildlife Services, The Nature Conservatory, Arizona Game and Fish Department, Arizona Department of Public Safety, Federal Highway Administration, Arizona State Land Department, and Central Arizona Fire & Medical Authority.

The study will address current and future conditions and draft a plan of improvement to the study area. Following these deliverables, a public involvement meeting will be hosted and summarized. The study will conclude with the development and refinement of conceptual engineering plans for study area improvements and completion of a final report document.

Figure 1: Study Area



2.0 Needs Summary

Working Paper 1 detailed the current and future conditions for the study area. Upon reviewing the current pavement and bridge conditions, assessing historical safety incidents, and determining the current and future mobility and freight levels of service and accommodations, the following corridor needs have been identified:

- There are no pavement needs identified throughout the corridor
- There are no bridge needs identified along any bridge structure within the corridor
- There is a safety need identified along the entire corridor
    - The SR 89A corridor has an above average total crash rate
    - The Robert Road intersection has experienced multiple fatality resulting incidents
- Increasing future traffic volumes due to continued development of the corridor area has led to emerging mobility concerns along the corridor.
    - Additions to roadway capacity will need to be considered in future roadway improvements
    - Future roadway improvements should take freight and oversized load freight into consideration in the development of future roadway geometries.

In order to better understand the roadway capacity needs, a multi-year traffic analysis was conducted to identify when capacity concerns would first develop throughout the corridor. Mainline and intersection projected volumes for Year 2025, 2030 and 2035 were developed by utilizing a linear growth rate between the 2017 existing and post-processed Year 2040 volumes. Balanced volumes were developed for each year within the corridor by following a similar methodology that was used to develop AM and PM peak hour 2040 volumes, as explained in Working Paper #1. It was assumed that the fourth leg of Glassford Hill Road traffic interchange would be expanded and utilized by additional development to the north by the Year 2030.

An operational analysis was performed for the mainline including the general-purpose lanes, ramp junctions, and weave sections for the no-build conditions for each of the horizon years. Intersection analysis was also performed for the study intersections including the five TI's and one at-grade signalized intersection. This levels-of-service (LOS) analysis was conducted following the methodologies described in Working Paper #1, Section 3.3.5. **Table 1** and **Table 2** include the anticipated No-Build Year 2025, 2030, and 2035 LOS results during the AM and PM Peak Hours for the intersections, respectively. **Table 3** include the anticipated No-Build Year 2025, 2030, and 2035 LOS results during the AM and PM Peak Hours for the mainline. These tables also include the existing 2017 and anticipated Year 2040 No-Build results for comparison purposes. **Appendix 1** includes visual representation of the volumes and results for the 2025 – 2040 Years.

The following summarizes the results of each facility over time:

SR 89A Eastbound Mainline – In the AM peak hour, the eastbound mainline continues to function at LOS D or better until 2040. By 2040, congestion at the Granite Dells intersection causes the mainline to operate at LOS F between SR 89 and Granite Dells. In the PM peak hour, congestion at the Viewpoint Drive intersection causes the mainline between Glassford Hill Road and Viewpoint Drive to operate at LOS F by Year 2030. By Year 2040, this congestion is compounded by congestion at the Glassford Hill Road and Granite Dells interchanges, causing the eastbound mainline to operate at LOS E or F between Viewpoint Drive and Granite Dells, and between Granite Dells and SR 89.

SR 89A Westbound Mainline – In the AM peak hour, congestion at SR 89 causes the westbound mainline to operate at LOS F between SR 89 and Larry Caldwell Drive by Year 2025. This congestion continues to worsen until by Year 2035 the mainline is operating at LOS F between SR 89 and Glassford Hill Road. In the PM peak hour, the westbound mainline continues to operate at LOS D or better through Year 2040.

SR 89 Traffic Interchange – The signalized intersection of SR 89A Ramps and SR 89 begins to degrade in the AM peak hour by Year 2035. By Year 2035 one approach is operating at LOS E and by Year 2040, two approaches. In the PM peak hour, one approach of this interchange begins to operate at LOS E by Year 2025. By Year 2030, the overall intersection operates at LOS E, and by Year 2040 at LOS F.

Larry Caldwell Drive Traffic Interchange – The stop-controlled intersection of SR 89A Ramps and Larry Caldwell Drive operates at LOS B or better, with every approach operating at LOS D or better through Year 2040 in both the AM and PM peak hours.

Granite Dells Parkway Traffic Interchange –The roundabout intersections of SR 89A Ramps and Granite Dells Parkway in the AM peak hour degrades to LOS 'F' on three approaches and LOS 'F' overall by Year 2040. In the PM peak hour, the eastbound approach degrades to LOS 'F' and the northbound approach to LOS 'E' by Year 2040.

Glassford Hill Road Traffic Interchange – The signalized intersection of SR 89A Ramps and Glassford Hill Road operates in the AM peak hour at LOS E by Year 2025, and degrades to LOS F by Year 2030. The same is true in the PM peak hour, with the overall intersection operating at LOS E by Year 2025 and LOS F by Year 2030.

Viewpoint Drive Traffic Interchange – In the AM peak hour, the signalized intersection of SR 89A and Viewpoint Drive operates at LOS D or better at every approach and overall through Year 2040. In the PM peak hour, the overall intersection maintains LOS D or better through Year 2040, but the eastbound approach operates at LOS E by Year 2030 and LOS F by Year 2035.

Robert Road/Fain Road Intersection – The signalized intersection of SR 89A, Fain Road, and Robert Road is the only at-grade intersection with the SR 89A mainline in the corridor. In the AM peak hour, the northbound approach to this intersection operates at LOS E by Year 2025 and LOS F by Year 2030. The overall intersection operates at LOS E by Year 2035 and LOS F by Year 2040. In the PM peak hour, the northbound approach operates at LOS F by Year 2030. The overall intersection operates at LOS E by Year 2040.

Table 1: AM Peak Hour No-Build Comparison Intersection LOS Results

Intersection Location	Intersection Approach	2017 AM Existing		2025 AM No-Build		2030 AM No-Build		2035 AM No-Build		2040 AM No-Build	
		Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay
SR 89A and SR 89 TI (signalized)	EB SR 89A Off Ramp	D (39)	C (31.7)	D (53)	D (43.2)	D (53)	D (42.3)	**E (55)**	D (46.4)	**E (75)**	D (54.5)
	WB SR 89A Off Ramp	C (32)		D (44)		D (37)		D (40)		D (40)	
	NB SR 89	C (25)		D (37)		D (37)		D (40)		D (51)	
	SB SR 89	C (33)		D (43)		D (47)		D (53)		**E (64)**	
SR 89A and Larry Caldwell Dr. TI (unsignalized)	EB SR 89A Frontage Road	B (14)	A (8)	B (18)	A (9.2)	C (21)	B (11.5)	C (25)	B (13.1)	D (38)	B (17.4)
	WB SR 89A Off Ramp	A (9)		B (11)		B (17)		C (21)		C (22)	
	NB Larry Caldwell Dr	A (1)		A (1)		A (2)		A (2)		A (2)	
	SB Larry Caldwell Dr	A (0)		A (1)		A (1)		A (1)		A (1)	
SR 89A and Granite Dells Pkwy TI (roundabout)	EB SR 89A Off Ramp	A (0)	A (0.6)	A (7)	A (4.9)	A (7)	A (6.1)	B (11)	D (49.3)	**F (101)**	**F (297.6)**
	WB SR 89A Off Ramp	A (1)		A (5)		A (7)		B (13)		**F (164)**	
	NB Granite Dells Pkwy	A (0)		A (3)		A (3)		A (4)		A (6)	
	SB Granite Dells Pkwy	A (1)		A (5)		A (7)		**F (148)**		**F (815)**	
SR 89A and Glassford Hill Rd. TI (signalized)	EB SR 89A Off Ramp	B (17)	C (27)	C (29)	**E (57.5)**	C (31)	**F (141.0)**	C (33)	**F (144.0)**	C (34)	**F (179.4)**
	WB SR 89A Off Ramp	D (45)		**E (55)**		**E (58)**		**E (67)**		**F (85)**	
	NB Glassford Hill Rd	C (24)		**E (73)**		**F (277)**		**F (303)**		**F (363)**	
	SB Glassford Hill Rd	N/A		N/A		D (38)		D (42)		**F (167)**	
SR 89A and Viewpoint Dr. TI (signalized)	EB SR 89A Off Ramp	B (12)	B (13)	B (17)	B (19.2)	C (21)	C (24.0)	C (26)	C (33.4)	C (23)	C (34.6)
	WB SR 89A Off Ramp	C (24)		C (31)		D (36)		D (41)		D (38)	
	NB Viewpoint Dr	B (20)		C (31)		D (37)		D (46)		D (43)	
	SB Viewpoint Dr	A (8)		B (13)		B (18)		C (30)		D (35)	
SR 89A and Robert Road (signalized)	EB SR 89A	C (22)	C (23.5)	C (28)	D (35.5)	C (28)	D (50.3)	C (28)	**E (59.2)**	C (28)	**F (90.9)**
	WB Fain Rd	C (27)		D (36)		D (38)		**E (61)**		**F (143)**	
	NB Robert Rd	C (26)		**E (61)**		**F (135)**		**F (145)**		**F (142)**	
	SB SR 89A	B (18)		B (20)		C (22)		C (27)		C (28)	

Table 2: PM Peak Hour No-Build Comparison Intersection LOS Results

Intersection Location	Intersection Approach	2017 PM Existing		2025 PM No-Build		2030 PM No-Build		2035 PM No-Build		2040 PM No-Build	
		Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay
SR 89A and SR 89 TI (signalized)	EB SR 89A Off Ramp	D (42)	C (25.4)	**E (74)**	D (47.9)	**E (64)**	**E (61.7)**	**F (87)**	**E (71.7)**	**F (155)**	**F (81.0)**
	WB SR 89A Off Ramp	C (27)		D (45)		**F (80)**		**F (82)**		**F (82)**	
	NB SR 89	C (22)		D (52)		**E (64)**		**F (87)**		**F (99)**	
	SB SR 89	C (25)		D (38)		C (34)		D (35)		D (43)	
SR 89A and Larry Caldwell Dr. TI (unsignalized)	EB SR 89A Frontage Road	A (9)	A (2.5)	B (11)	A (3.8)	B (12)	A (4.7)	B (14)	A (5.3)	A (14)	A (5.1)
	WB SR 89A Off Ramp	A (7)		A (7)		A (8)		A (8)		A (8)	
	NB Larry Caldwell Dr	A (1)		A (2)		A (2)		A (2)		A (3)	
	SB Larry Caldwell Dr	A (1)		A (1)		A (1)		A (1)		A (2)	
SR 89A and Granite Dells Pkwy TI (roundabout)	EB SR 89A Off Ramp	A (0)	A (0.4)	A (5)	A (4.2)	A (7)	A (5.6)	B (18)	A (9.5)	**F (89)**	D (46.0)
	WB SR 89A Off Ramp	A (1)		A (4)		A (5)		A (7)		A (7)	
	NB Granite Dells Pkwy	A (0)		A (3)		A (4)		A (6)		**E (58)**	
	SB Granite Dells Pkwy	A (0)		A (5)		A (7)		A (8)		A (9)	
SR 89A and Glassford Hill Rd. TI (signalized)	EB SR 89A Off Ramp	C (22)	C (25.4)	**F (119)**	**E (62.3)**	D (48)	**F (80.5)**	**E (69)**	**F (191.5)**	D (48)	**F (150.9)**
	WB SR 89A Off Ramp	D (53)		**E (57)**		**E (73)**		**E (76)**		**E (66)**	
	NB Glassford Hill Rd	B (20)		C (26)		**F (117)**		**F (274)**		**F (337)**	
	SB Glassford Hill Rd	N/A		N/A		**E (58)**		**E (64)**		**E (61)**	
SR 89A and Viewpoint Dr. TI (signalized)	EB SR 89A Off Ramp	B (15)	B (17.1)	D (46)	D (35.9)	**E (75)**	D (47.9)	**F (84)**	D (49.7)	**F (82)**	D (48.2)
	WB SR 89A Off Ramp	C (32)		D (39)		D (38)		D (40)		D (37)	
	NB Viewpoint Dr	C (22)		C (31)		C (34)		D (36)		D (35)	
	SB Viewpoint Dr	B (12)		B (16)		B (17)		B (18)		B (17)	
SR 89A and Robert Road (signalized)	EB SR 89A	C (21)	C (23.1)	C (27)	C (29.1)	C (32)	D (39.6)	C (32)	D (54.2)	D (39)	**E (56.5)**
	WB Fain Rd	C (27)		C (33)		C (33)		C (33)		D (38)	
	NB Robert Rd	C (29)		D (42)		**F (83)**		**F (164)**		**F (171)**	
	SB SR 89A	B (18)		B (17)		B (19)		C (20)		C (21)	

Table 3: AM & PM Peak Hour No-Build Comparison SR 89A Mainline LOS Results

Segment Description	AM Peak Hour										PM Peak Hour									
	2017 Existing		2025 No-Build		2030 No-Build		2035 No-Build		2040 No-Build		2017 Existing		2025 No-Build		2030 No-Build		2035 No-Build		2040 No-Build	
	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS
Eastbound/Northbound SR 89A																				
Project Limit to SR 89 EB Exit Ramp	8	A	9	A	12	B	13	B	16	B	12	B	18	C	23	C	26	D	42	D
SR 89 EB Exit Ramp to SR 89 EB Entr Ramp	5	A	5	A	7	A	8	A	11	A	9	A	13	B	18	C	19	C	21	C
SR 89 EB Entrance Ramp to Larry Caldwell EB Entr Ramp	9	A	11	B	13	B	14	B	72	F	14	B	19	C	24	C	26	C	40	E
Larry Caldwell EB Entr Ramp to Granite Dells EB Exit Ramp	6	A	8	A	10	A	11	B	108	F	11	B	15	B	20	C	26	C	57	F
Granite Dells EB Exit Ramp to Granite Dells EB Entr Ramp	8	A	9	A	9	A	10	A	9	A	16	B	18	B	20	C	20	C	24	C
Granite Dells EB Entr Ramp to Glassford Hill EB Exit Ramp	9	A	13	B	15	B	17	B	16	B	16	B	22	C	26	D	34	D	44	E
Glassford Hill EB Exit Ramp to Glassford Hill EB Entr Ramp	4	A	7	A	8	A	9	A	8	A	9	A	13	B	48	F	65	F	104	F
Glassford Hill EB Entr Ramp to Viewpoint Dr EB Exit Ramp	4	A	7	A	7	A	8	A	7	A	9	A	15	B	127	F	138	F	150	F
Viewpoint Dr EB Exit Ramp to Viewpoint Dr EB Entr Ramp	4	A	5	A	5	A	6	A	6	A	6	A	9	A	8	A	8	A	10	A
Viewpoint Dr EB Entr Ramp to Robert Road Intersection	4	A	6	A	7	A	8	A	8	A	7	A	10	A	9	A	10	A	11	B
Westbound/Southbound SR 89A																				
Robert Road Intersection to Viewpoint Dr WB Exit Ramp	6	A	9	A	10	A	12	B	13	B	4	A	5	A	6	A	7	A	8	A
Viewpoint Dr WB Exit Ramp to Viewpoint Dr WB Entr Ramp	8	A	12	B	13	B	15	B	16	B	5	A	6	A	8	A	8	A	10	A
Viewpoint Dr WB Entr Ramp to Glassford Hill WB Exit Ramp	11	A	16	B	20	C	25	C	30	D	5	A	8	A	9	A	10	A	12	B
Glassford Hill WB Exit Ramp to Glassford Hill WB Entr Ramp	12	B	17	B	19	C	23	C	24	C	5	A	7	A	9	A	9	A	11	B
Glassford Hill WB Entr Ramp to Granite Dells WB Exit Ramp	19	C	26	D	31	D	55	F	56	F	10	A	14	B	16	B	17	B	18	B
Granite Dells WB Exit Ramp to Granite Dells WB Entr Ramp	18	C	22	C	51	F	96	F	53	F	10	A	11	A	11	A	10	A	11	A
Granite Dells WB Entr Ramp to Larry Caldwell WB Exit Ramp	13	B	18	C	87	F	112	F	101	F	7	A	10	A	14	B	12	B	10	A
Larry Caldwell WB Exit Ramp to SR 89 WB Exit Ramp	21	C	56	F	111	F	114	F	111	F	10	A	15	B	33	D	34	D	33	D
SR 89 WB Exit Ramp to SR 89 WB Entr Ramp	11	A	16	B	18	C	19	C	23	C	5	A	7	A	8	A	8	A	7	A
SR 89 WB Entr Ramp to Project Limit	15	B	23	C	26	D	27	D	27	D	8	A	11	B	13	B	14	B	14	B

3.0 Evaluation Criteria

3.1 Recommended Criteria

Evaluation criteria were developed to assess improvement alternatives for the 2040 build scenario. The evaluation process was performed at all locations that presented multiple ultimate solution alternatives. Given the different needs between the mainline corridor and the corridor interchanges, separate criteria were developed for each independently. The evaluation criteria was grouped into five major categories; mobility and constructability, safety, regional preference, utility impact, and costs. Given the singular solution identified for the corridor mainline, only interchange/intersection specific criteria were established. Furthermore, all near-term and intermediate-term solutions were excluded from the alternatives evaluation. These solutions' implementation timing was determined based upon future level-of-service analysis and immediate safety needs.

In order to establish a comprehensive and regionally appropriate evaluation, the technical advisory committee project team was requested to provide feedback upon all preliminary evaluation criteria. This was successfully accomplished by conducting a survey in order to determine both a set of critically important criteria as well as any non-applicable or non-desirable criteria.

In total, nine surveys were completed and used to establish the finalized list of evaluation criteria. The survey responses can be seen in **Figure 2**. Using the survey responses as the primary guidance, the preliminary evaluation criteria were refined to formulate appropriate criteria for intersection alternative. The following is a list and description of the finalized intersection design criteria.

Mobility and Constructability

Level of service – quantitative measurement of both AM and PM Peak Level of Service measurements

Constructability / Maintenance of Traffic – qualitative measure of the ease or complexity of traffic control and traffic impacts during construction periods

Safety

Conflict points – quantitative measure of both vehicular and pedestrian conflict points present

Predictive safety analysis – quantitative measure analyzing the predicted reduction in total and serious injury crashes

Regional Preferences

Consistency with plans – qualitative measure of a suggested improvement's alignment with previous recommendations derived from completed studies

Agency and Public Acceptance – qualitative measure of stakeholder and the general public's acceptance of suggested improvement

ROW Acquisition Displacements – quantitative measure of expected residential, commercial, or institutional displacements required to implement suggested improvement

Protected Population Impact – qualitative measure of expected impact to protected population groups as outlined by Title VI Civil Rights in implementing suggested improvements

Utility Impact – qualitative measure of expected impacts to existing utility infrastructure to implement suggested improvements

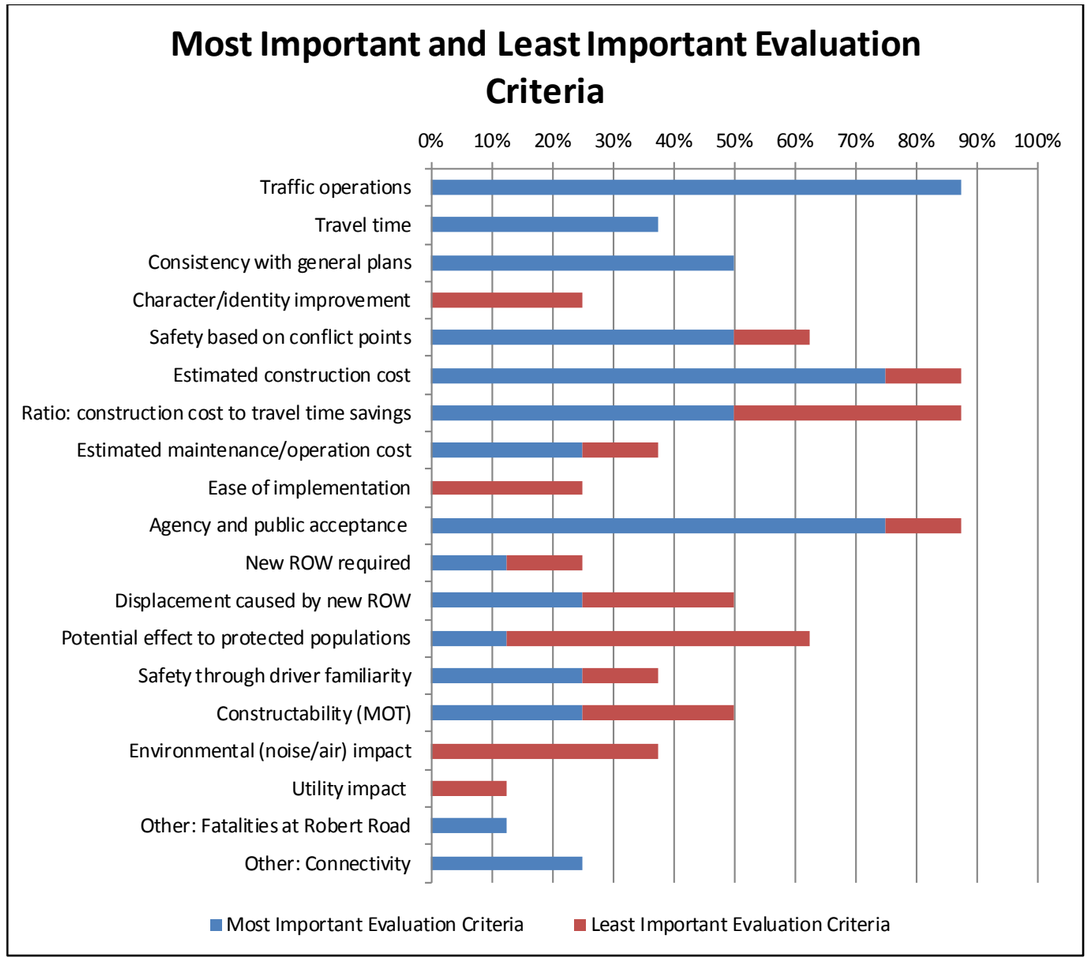
Project Costs

Construction Cost – quantitative measurement of the total cost of construction, including contingency to implement suggested improvements (does not include design, right-of-way, or additional expenses). Planning level construction cost estimates were prepared for all proposed improvements

Operations and Maintenance – qualitative measure of expected maintenance and operation costs of suggested improvement implementation

New Right-of-way required – quantitative measure of expected acres of additional right-of-way acquisition required to implement suggested improvements

Figure 2: Evaluation Criteria TAC Survey



3.2 Criteria Weighting

Using the distribution of favorable and non-favorable survey responses as the primary guiding determination, the criteria were grouped into weighted tiers. Three tiers were established; the top tier received a weight of 1.4, corresponding to the criteria receiving the highest amount of favorable response; the middle tier received a weight of 1.2; and the bottom tier received a weight of 1.0, corresponding to the criteria receiving the lowest amount of favorable response. Criteria that received significant unfavorable response and/or were determined to be non-implementable for the study areas were eliminated from further consideration. The final evaluation criteria tier categorization is as follows:

Tier 1

Weighting Factor – 1.4

Criteria: Level of Service, Construction Cost, and Agency & Public Acceptance

Tier 2

Weighting Factor – 1.2

Criteria: Conflict Points, Predictive Safety Analysis, Consistency with Plans

Tier 3

Weighting Factor – 1.0

Criteria: Constructability (Maintenance of Traffic), Utility Impact, Protected Population Impact, Right-of-Way Acquisition Displacements, Operation and Maintenance Costs, and New Right-of-Way Required

4.0 Potential Corridor Improvements

4.1 Introduction

Potential corridor improvements were developed by investigating the corridor needs for each year as described in Section 2.0 and brainstorming mitigation measures for these needs with the core project team. Additional corridor improvements were developed from direction provided by the TAC regarding corridor needs and safety needs from the detailed safety analysis. The following text describes each of the potential corridor improvements developed by location along the corridor.

4.2 SR 89A Mainline (Additional General Purpose Lane)

No-Build Conditions
The existing typical section for SR 89A consists of two 12 foot general purpose lanes with a four foot inside shoulder and ten foot outside shoulder in each direction. The median width is 38 feet, extending between SR 89 to directly west of the Robert Rd intersection. The roadway converges to a flush paved median for approximately 250 feet prior to the at-grade Robert Rd intersection. Additional roadway features include eastbound and westbound auxiliary lanes between Larry Caldwell Drive and Granite Dells Parkway, and between Glassford Hill Road and Viewpoint Drive.

Design Alternative
The design would construct an additional 12 foot lane in the median in both directions, with median barrier. The inside shoulder width would be adjusted to 12 feet, while the outside shoulder would be widened from 10 to 12 feet. This new design would widen the cross-section by a total of eight feet, widening the outside edge of roadway by four feet of the existing edge of pavement in both directions. Bridge structures over Granite Creek and Glassford Hill Road would need to be widened to the median side to accommodate the additional lane and shoulder. A design variance would be required for the inside shoulder width at the Larry Caldwell Drive and Granite Dells Parkway overpasses due to existing bridge piers located in the center of the alignment of the proposed median. Design variances for the outside shoulder width would also be required at the Glassford Hill Road bridges, unless the outside of the bridge is widened or the inside shoulder is reduced to 10 feet across the bridges. **Figure 3** includes a visual example of this general purpose lane widening on a small segment of the corridor.

4.3 SR 89 Traffic Interchange (Additional Eastbound Left-turn Lane)

No-Build Conditions
The existing eastbound exit ramp at SR 89 is a single lane ramp with a two-lane throat. The left lane is used for left-turns and through movements, while the right- lane is used for right-turns only. Additionally, signal timing green time allocation is significantly reduced for the eastbound exit movement to provide greater green time length to the SR 89 southbound movement in the morning or the SR 89A westbound ramp movement in the evening, causing insufficient timing to empty left-turn queues.

Design Alternative
In order to meet demand for left-turns and through movements, this alternative would construct an additional left-turn lane to the left side of the ramp at the throat. The center lane would also be restriped to permit both left-turns and through movements, and the right lane would remain as right-turn only. **Figure 4** includes a visual example of this proposed improvement.

4.4 SR 89 Eastbound Entrance Ramp Reconfiguration (Two Lane Entrance Ramp)

No-Build Conditions
The existing eastbound entrance ramp at SR 89 is a two-lane throat that diverges into a single-lane entrance to SR 89A and a single-lane frontage road that continues east to Larry Caldwell Drive. Two left turn lanes exist from southbound SR 89 to the eastbound ramp, but one of these lanes is under-utilized due to the ramp configuration, which forces drivers to proactively choose lanes prior to the turn in order to avoid a quick merge into their intended lane depending on their destination.

A safety issue currently exists, in which eastbound SR 89A mainline traffic is able to cross over the paved gore between the mainline and the entrance ramp and the paved gore between the entrance ramp and the frontage road in order to get to the eastbound frontage road. Drivers traveling eastbound along Pioneer Parkway are attempting this non-permitted maneuver in order to bypass the intended route of exiting at SR 89 and continuing through the intersection to the frontage road. Given there is no direct mainline exit to access Larry Caldwell Drive, this movement is likely intended to bypass the traffic light at the SR 89 intersection.

Design Alternatives
(Option 1): This design alternative would add a two-lane entrance to SR 89A, with the right lane having an option to continue east on the frontage road to Larry Caldwell Drive. The two-lane ramp would drop the right lane with a taper beginning near the entrance gore, in accordance with Figure 504.8B of the ADOT Roadway Design Guidelines. Concrete barriers and realignment of the mainline gore and the frontage road gore locations eliminate the ability to make the dangerous crossover maneuver from the mainline to the frontage road, reducing the safety concerns at this location.

(Option 2): This design alternative would add a two-lane entrance to SR 89A, with the right lane having an option to continue east on the frontage road to Larry Caldwell Drive. East of the bridge over SR 89, the two lanes on the mainline would realign toward the median into the ultimate three-lane configuration, while the two ramp lanes would enter SR 89A together. The outside lane will drop with a taper west of the Larry Caldwell Drive overpass, with three lanes remaining in the eastbound direction. Concrete barriers and realignments of the mainline gore and the frontage

road gore locations eliminate the ability to make the dangerous crossover maneuver from the mainline to the frontage road, reducing the safety concerns at this location. Option 1 has the ability to transition post-construction into Option 2 with minimal adjustments to the design of the ramp gores and barriers at such a time that Option 2 will be required.

Figure 5 and **Figure 6** include visual examples of the Option 1 and Option 2 proposed improvements, respectively.

4.5 Granite Dells Parkway Traffic Interchange

No-Build Conditions

The existing interchange of Granite Dells Parkway and SR 89A is a diamond interchange with roundabouts at each ramp intersection. Both intersections are configured as double-lane roundabouts. The southbound leg of the northern interchange is currently closed to through traffic with Granite Dells Parkway currently terminating at the intersection. Both eastbound and westbound exit ramps enable a fully protected free-right movement, with the westbound exit's northbound turn options being prohibited with temporary barriers until further extension of Granite Dells Parkway. Furthermore, the northbound approach to the eastbound on-ramp has a fully protected free-right.

Design Alternative – Roundabout modifications

The proposed design alternative modifies the northern roundabout to allow double left-turns from the westbound exit ramp to southbound Granite Dells Parkway. The southern roundabout would also be modified to allow double left-turns from southbound Granite Dells Parkway to the eastbound entrance ramp and double left turns from the eastbound exit ramp to northbound Granite Dells Parkway. These modifications can be made by adding a spiraled lane into the existing center circle, enabling most of the existing approaches and departures to be maintained. **Figure 7** includes a visual example of this proposed improvement.

Design Alternative – Minimal Lane adjustment (southbound free right)

The proposed design alternative adds a free-right turn to the north roundabout for southbound to westbound traffic to accommodate projected future volumes originating from development north of the corridor and completion of roadway access along the northern leg. Additionally, the westbound on-ramp would be widened to the outside to accommodate a third lane, created from the free-right turn for a short length before the outside lane is removed with a taper. **Figure 8** includes a visual example of this proposed improvement.

4.6 Great Western Drive

No-Build Conditions

Existing Great Western Drive is a local access road with an at-grade, unsignalized intersection with SR 89A. A median crossover provides access to and from westbound SR 89A with a dedicated left-turn lane and approximately 500 feet of flush paved median. Additionally, there is an eastbound right-turn lane. Currently, Great Western Drive provides access to a water tower adjacent to the SR 89A corridor, but terminates at this exit, prohibiting any further connection to the roadway's former north/south alignment.

Design Alternative – Great Western Drive Closure

This design alternative is proposed for implementation in the interim short-term timeframe. In the interim condition with two lanes in each direction on SR 89A, all access from SR 89A to Great Western Drive would be closed, including the westbound left-turn lane and additional median crossing pavement would be removed in order to eliminate crossing traffic.

Design Alternative – Traffic interchange

As outlined in the CYMPO Regional Transportation Plan and the Yavapai County Great Western Corridor Feasibility Study, a grade separated traffic interchange is proposed for the Great Western Drive corridor. The layout is proposed to be a diamond interchange with an overpass across the SR 89A mainline. On the overpass, two through lanes and two left turn lanes are proposed in each direction. On the mainline, auxiliary lanes will provide access to exit ramps and from entrance ramps in both directions between Granite Dells Parkway and Glassford Hill Road, respectively. **Figure 9** includes a visual example of this proposed improvement.

Figure 3: General Purpose Lane Widening

Figure 4: SR 89 TI Improvements

Figure 5: SR 89 TI Eastbound Entrance Ramp Option 1

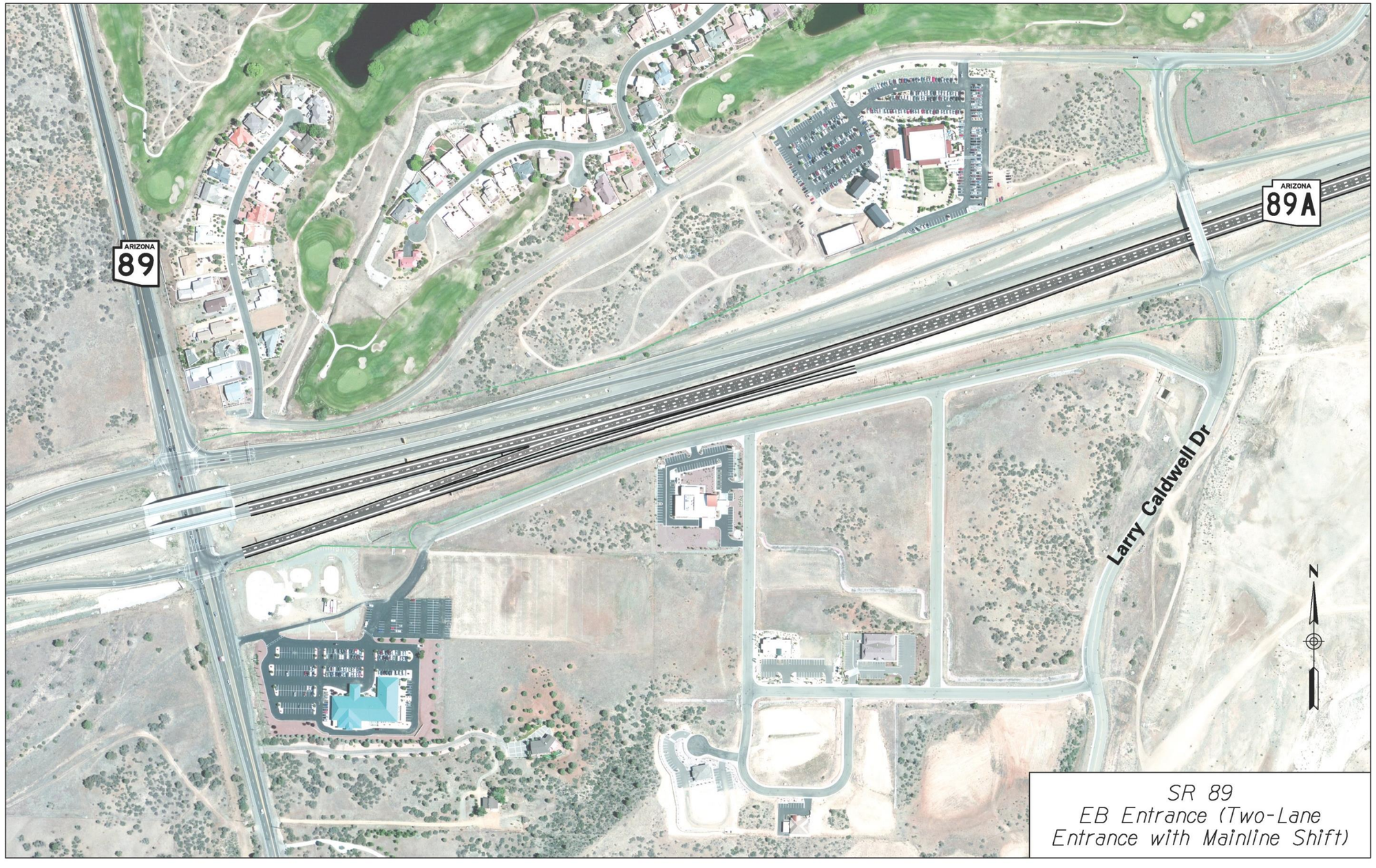


Figure 6: SR 89 TI Eastbound Entrance Ramp Option 2

Figure 7: Granite Dells TI Roundabout Lane Reconfiguration

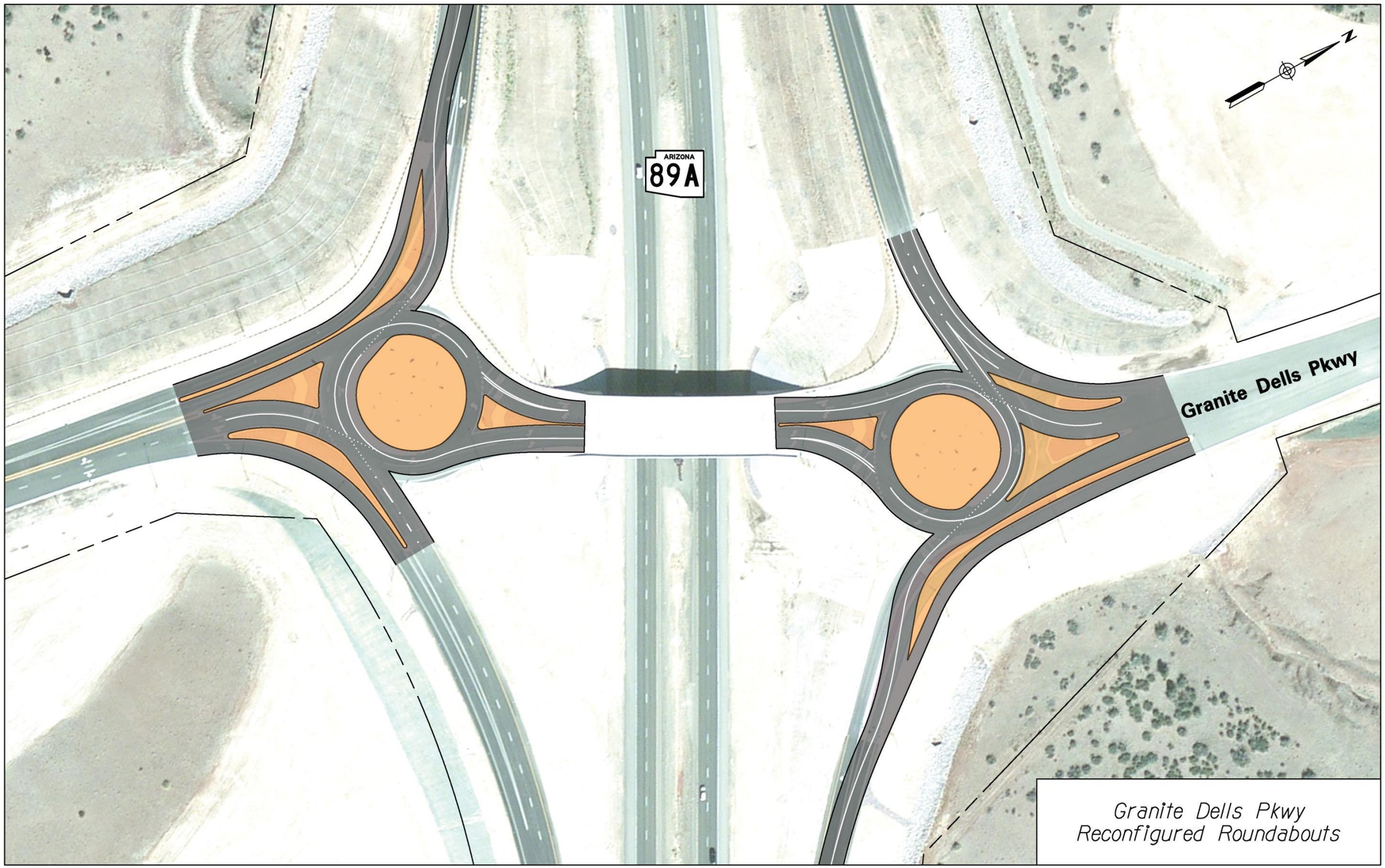


Figure 8: Granite Dells TI Roundabout Minimal Lane Adjustment (Southbound Free Right)

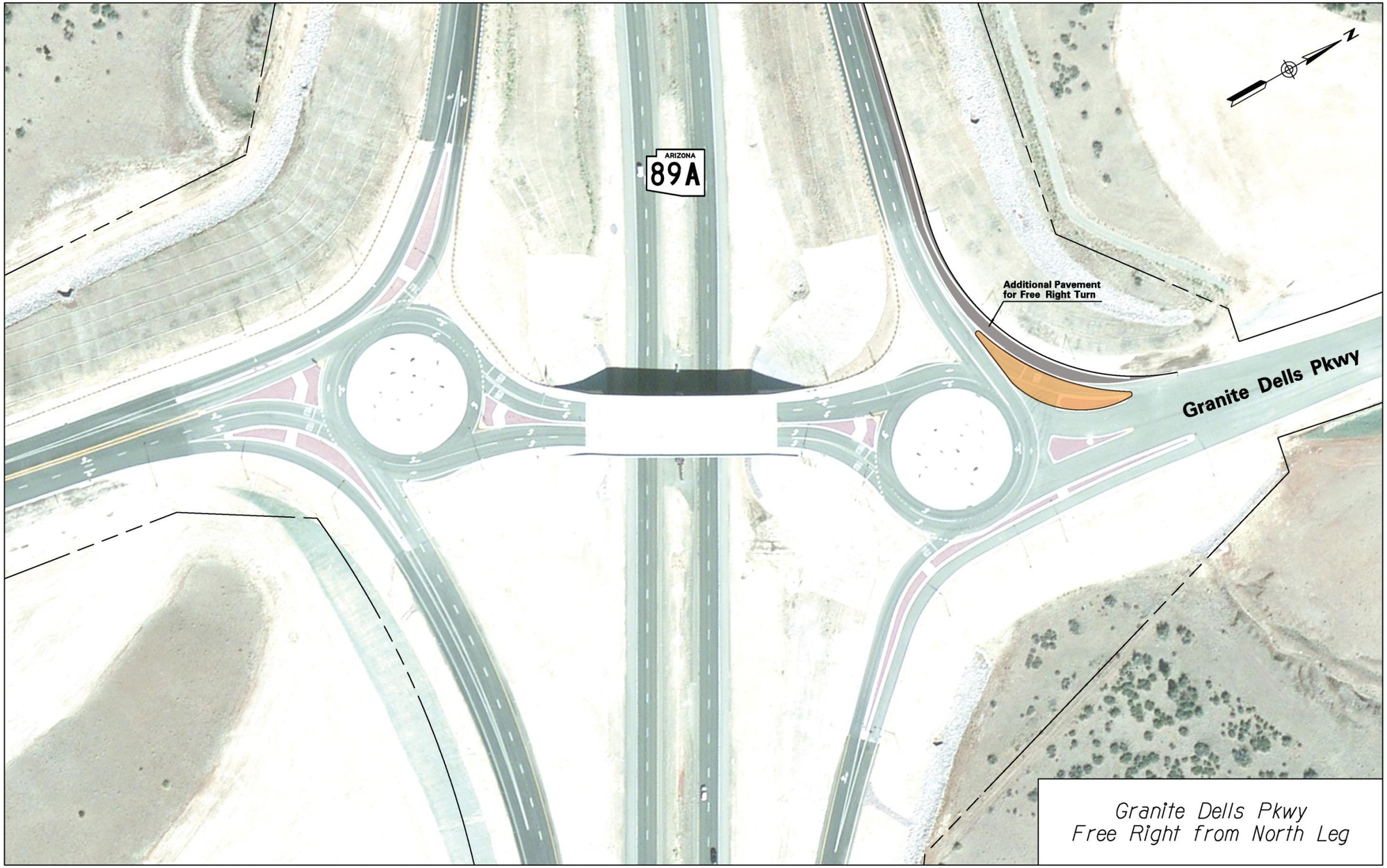
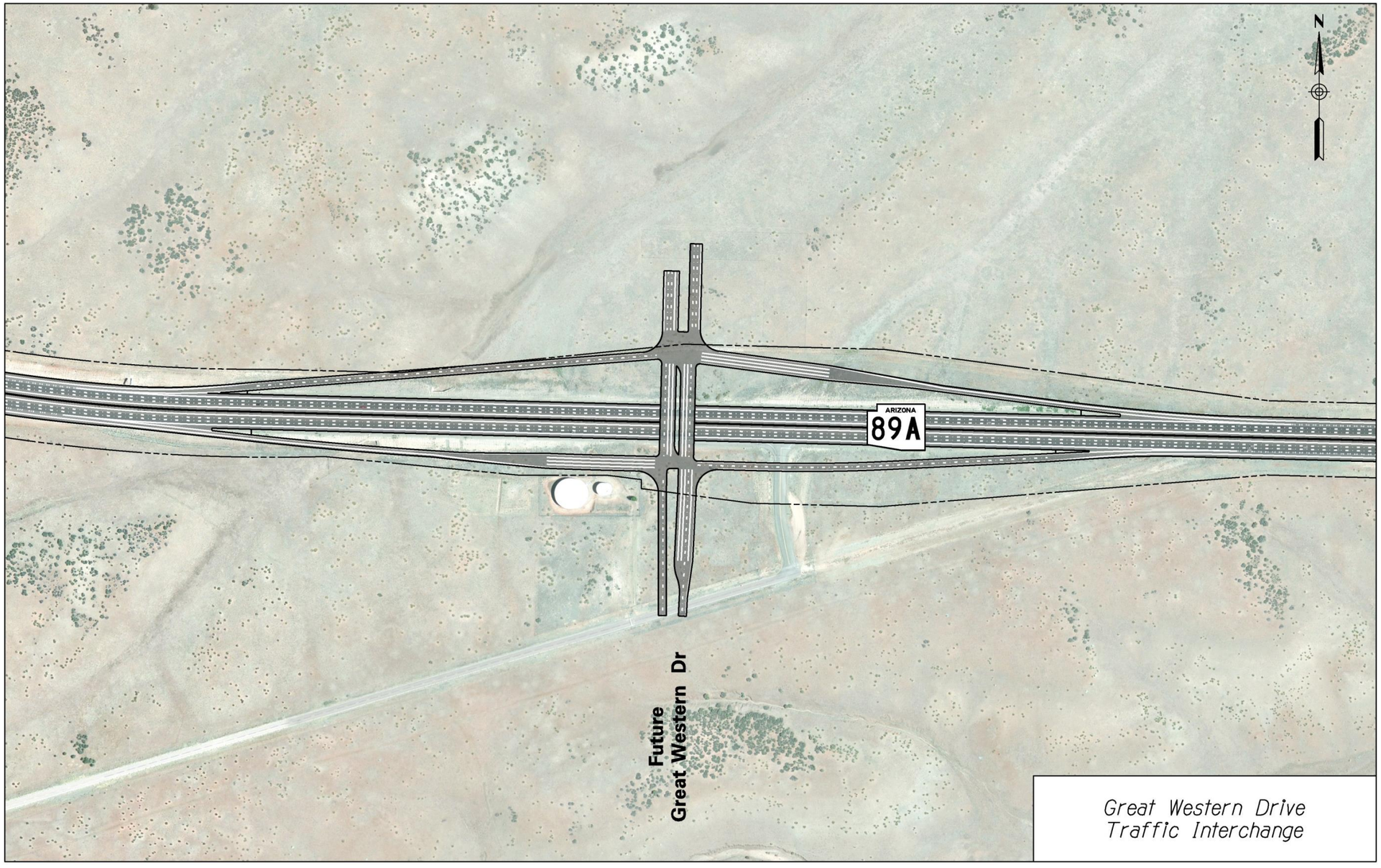


Figure 9: Great Western Drive TI



4.7 Glassford Hill Road Traffic Interchange

No-Build Conditions

The existing interchange of Glassford Hill Road and SR 89A is a diamond configuration, with SR 89A mainline passing over Glassford Hill Road. To the south, Glassford Hill Road is a two lane arterial roadway. North of the westbound entrance and exit ramps, the pavement on Glassford Hill Road ends at a locked gate, permitting service access only. Within the interchange, two through lanes and two left-turn lanes exist in the southbound direction. In the northbound direction, two left-turn lanes exist with adequate pavement to accommodate up to two future striped through lanes.

The eastbound exit ramp has a three lane throat, with a single left-turn lane, a through/right middle lane, and a right-turn lane. Glassford Hill Road is currently configured as a divided arterial roadway with two lanes traveling through the interchange and extending south in the southbound direction.

The westbound entrance ramp from Glassford Hill Road to SR 89A currently has a standard parallel entrance with a 700 foot acceleration lane past the striped gore and a 600 foot lane drop taper on the SR 89A mainline.

Design Alternative –Eastbound exit ramp free right-turn lane

This proposed alternative design includes an eastbound free-right turn created with the addition of channelization and a third southbound lane south of the ramp. The left-turn only lane would remain unchanged, while the center lane would be restriped as a through-only lane. **Figure 10** includes a visual example of this proposed improvement.

Design Alternative – Roundabout Interchange

The design alternative proposes double roundabouts to be added to the interchange at the locations of the existing ramp/crossroad intersections. Glassford Hill Road to the south of the interchange woud be increased to three lanes in each direction. Accommodations for a future development of a north leg of Glassford Hill Road would also be provided. The northern roundabout at the westbound entrance and exit ramps would be elliptical in order to enable a double left-turn for both northbound to westbound and westbound to southbound movements. Between the roundabouts, two lanes would be provided in each direction. **Figure 11** includes a visual example of this proposed improvement.

Design Alternative – Diverging diamond interchange (DDI)

The design alternative proposes a DDI at the interchange. A DDI is a unique configuration wherein traffic is temporarily shifted to the opposite side of the road in the crossroad section of the interchange between two intersection traffic signals. This configuration reduces conflict points and enables free left-turn movements to and from the ramps. This proposed design at the Glassford Hill Road interchange requires Glassford Hill Road be widened to three lanes in each direction south of the interchange. Accommodations for a future development of a north leg of Glassford Hill Road would also be provided. Three lanes would be provided in each direction between the ramps and an additional right-turn lane would be added to the eastbound exit ramp. **Figure 12** includes a visual example of this proposed improvement.

Design Alternative – Westbound extended parallel entrance ramp

The proposed design would extend the parallel entrance acceleration lane by approximately 600 feet for a total length of 1,300 feet. The acceleration lane would also extend the length of the lane drop with a 780 foot taper (65:1). **Figure 13** includes a visual example of this proposed improvement.

4.8 Viewpoint Drive Traffic Interchange

No-Build Conditions

The existing Viewpoint Drive interchange is a typical diamond configuration. The eastbound exit ramp at Viewpoint Drive has a three lane throat, with one left-turn, one through lane, and one right-turn lane. Between the ramps, there are three lanes in the northbound direction, including two left only lanes and a single through lane. There is adequate pavement width to accommodate an additional through northbound lane, which is currently striped out.

The westbound entrance ramp is a two lane ramp that tapers to one lane approximately 500 feet past the intersection with Viewpoint Drive. The existing pavement width is adequate to accommodate two lanes through the ramp to the SR 89A mainline gore prior to a necessary taper.

Continuing north of the interchange, Viewpoint Drive has one northbound lane separated from southbound traffic by a wide raised center median through to Pronghorn Ranch Parkway.

Design Alternative – Additional northbound lane and eastbound exit ramp dual left-turn

Between the ramps, the striped out pavement would be converted to an additional northbound lane. With this additional lane, the eastbound exit lane configuration can be changed to allow dual left-turns. The ramp lanes would be converted to one left-turn lane, a center left/through lane, and a right-turn lane. North of the interchange, an additional lane will be added along Viewpoint Drive from the interchange to Pronghorn Ranch Parkway. This additional lane will turn into a trap right turn lane at the Pronghorn Ranch Parkway intersection, and Viewpoint Drive will continue as a single northbound lane past the intersection. **Figure 14** includes a visual example of this proposed improvement.

Design Alternative – Westbound entrance ramp extension

The westbound entrance ramp would be restriped to carry two lanes approximately 1,500 feet past the existing taper location. The right lane would drop with a 600 foot taper (50:1) prior to merging with the SR 89A mainline. **Figure 15** includes a visual example of this proposed improvement.

Figure 10: Glassford Hill TI Eastbound Free Right-turn

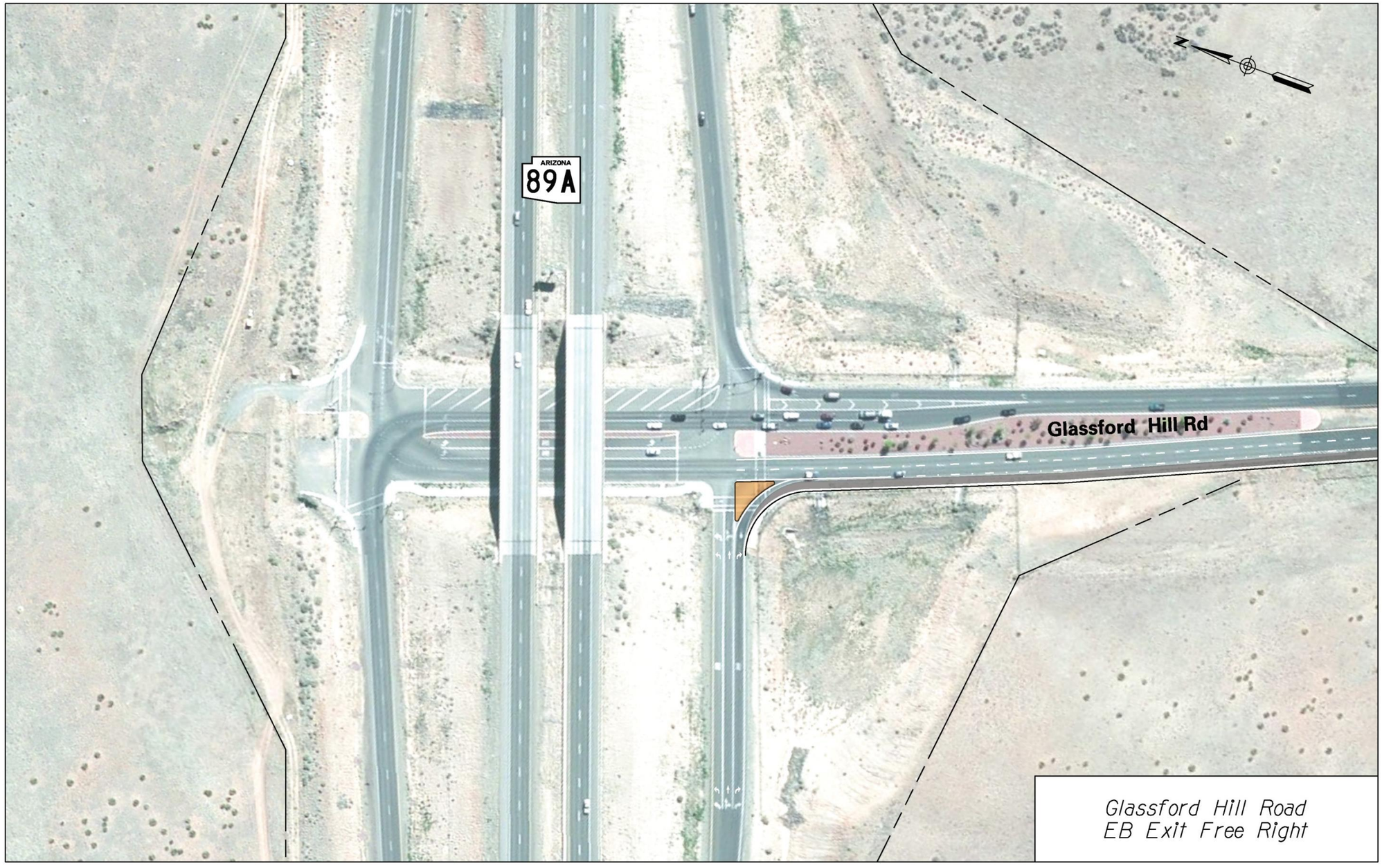


Figure 11: Glassford Hill TI Roundabout

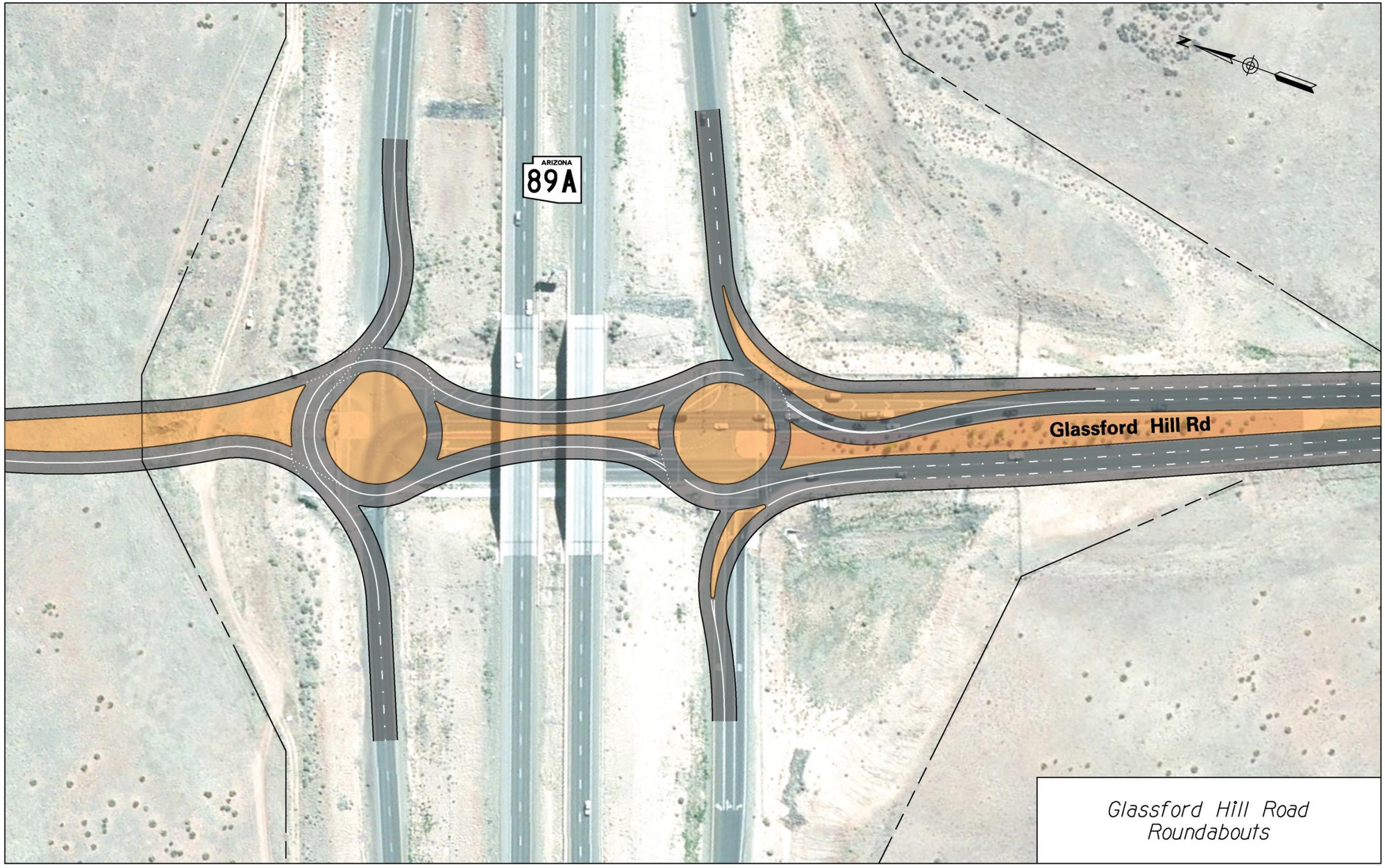


Figure 12: Glassford Hill TI Diverging Diamond Interchange

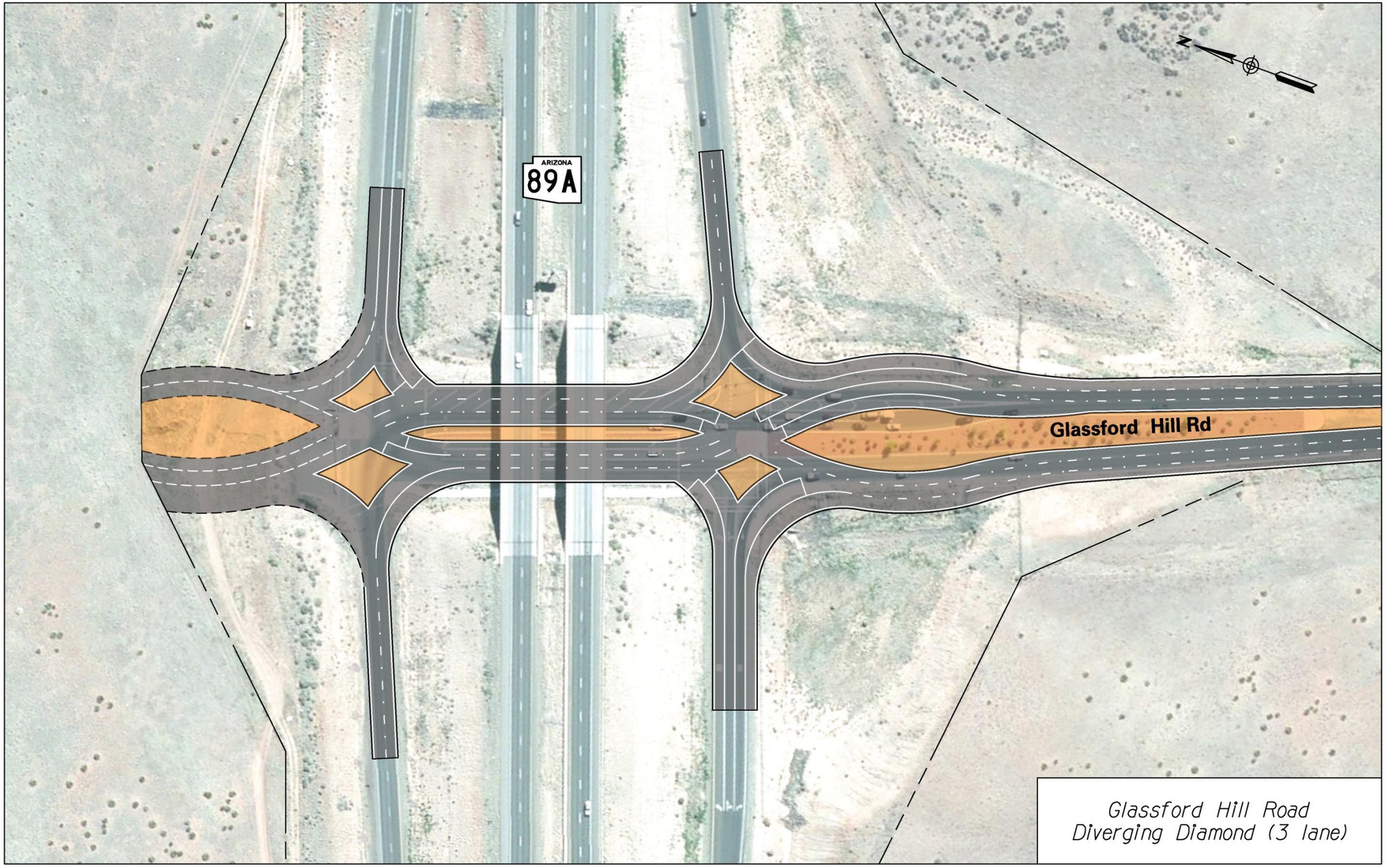


Figure 13: Glassford Hill TI Westbound Extended Parallel Entrance Ramp

Figure 14: Viewpoint Drive TI Additional Northbound Lane and Eastbound Dual Left-Turn

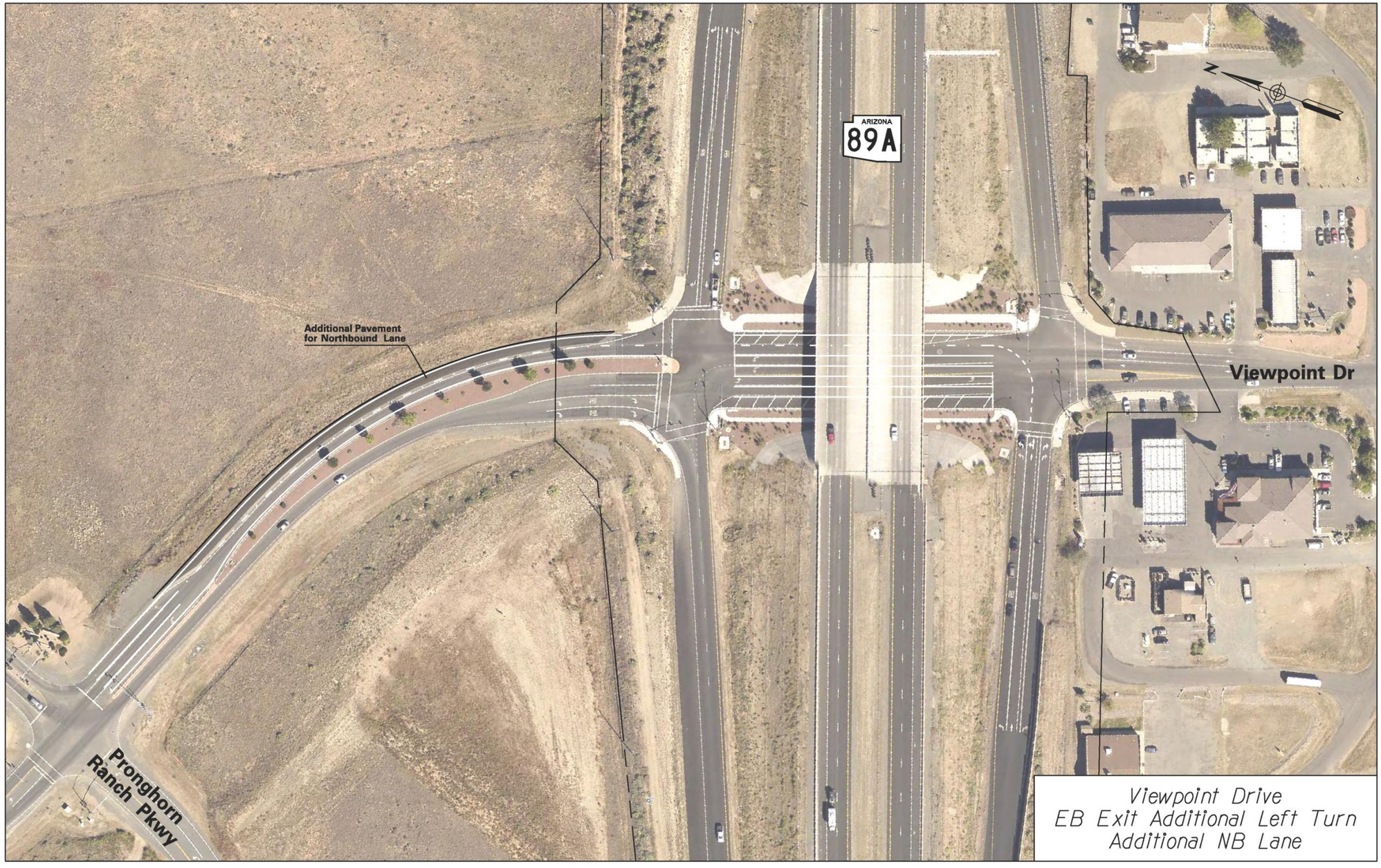


Figure 15: Viewpoint Drive TI Westbound Entrance Ramp Extended Lane

4.9 Robert Road/Fain Road Signalized Intersection

No-Build Conditions

Existing Robert Road intersects with SR 89A at an at-grade, signalized intersection. The SR 89A mainline is two lanes in each direction with dedicated left-turn lanes and right-turn lanes existing on the approaches and an open median separating the two directions of traffic. The intersection is designed on an angle with curves on both the north and south legs of Robert Road. South of the intersection, Robert Road includes two northbound lanes on the approach: a left-turn lane and a through/right-turn lane.

Design Alternative – Interim Signalized Intersection Improvements

South of the intersection, Robert Road would be restriped to accommodate an additional left-turn lane. The other two lanes will remain as in their existing configuration with a second left-turn lane and a through/right-turn lane. This proposed design would also include upgrading the signal heads and mast arms to address safety concerns at the intersection. **Figure 16** includes a visual example of this proposed improvement.

Design Alternative –Signalized Intersection Improvements

On the mainline, an additional lane would be added in the westbound direction on the median side, beginning approximately 1,500 feet east of the intersection along Fain Road. South of the intersection, Robert Road would be restriped to accommodate an additional left-turn lane. The other two lanes will remain as in their existing configuration with a second left-turn lane and a through/right-turn lane. This proposed design would also include upgrading the signal heads and mast arms to address safety concerns at the intersection. **Figure 17** includes a visual example of this proposed improvement.

Design Alternative - Roundabout

Proposed design alternative includes a two-lane roundabout which would replace the existing signalized intersection. A right-turn bypass lane will be added to the westbound, southbound and eastbound approaches. The roundabout would be designed to accommodate a third eastbound/westbound through lane if needed. **Figure 18** includes a visual example of this proposed improvement.

Design Alternative – Traffic Interchange

Proposed design alternative includes a grade separated traffic interchange for Robert Road, approximately 2,800 feet east of the existing intersection. The layout would be a diamond interchange with an overpass over the Fain Road mainline. On the overpass, two through lanes and two left-turn lanes would be added in the northbound direction and two through lanes and a single left-turn lane in the southbound direction of travel. On the mainline, exit ramps would be tapered, and entrance ramps would enter parallel into an acceleration lane.

North of the interchange, the cross road would continue north and connect with existing SR 89A. South of the interchange, the cross road would intersect with Robert Road south of the Prescott Valley Bible Church and Bright Futures Preschool located south of SR 89A along the existing Robert Road alignment. **Figure 19** includes a visual example of this proposed improvement.

Figure 16: Robert Road Signalized Intersection Improvements

Figure 17: Robert Road Signalized Intersection Improvements

Figure 18: Robert Road Roundabout

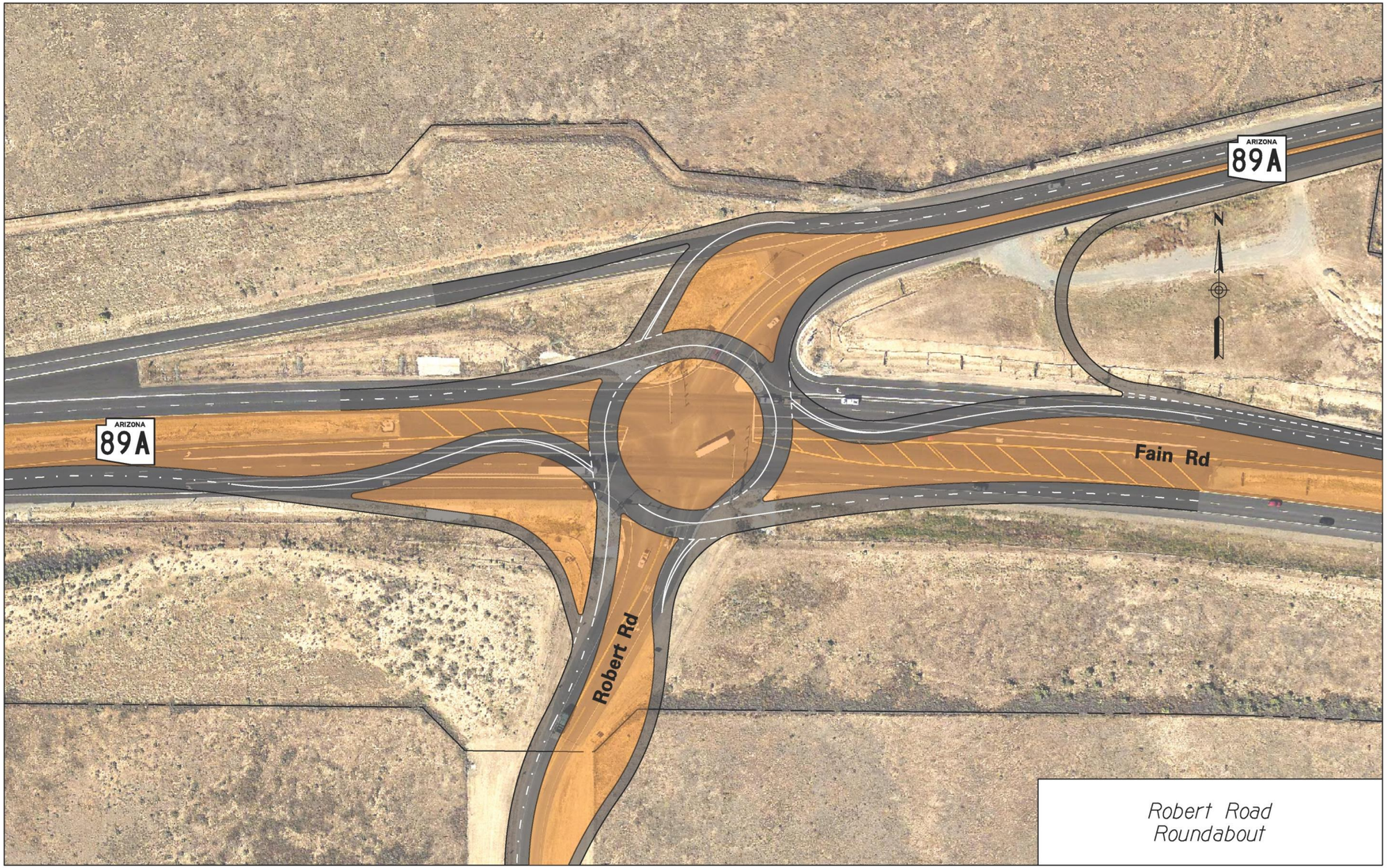


Figure 19: Robert Road Traffic Interchange

5.0 Alternatives Analysis & Recommendations

5.1 Introduction

Three sets of alternatives were evaluated within the study area to determine a recommended ultimate 2040 proposed improvement at each respective traffic interchange location where multiple proposed improvements were discussed. The three locations include the Granite Dells Parkway TI, the Glassford Hill TI, and the Robert Road Intersection. The SR 89A intersection locations and their respective alternatives include the following:

Granite Dells Parkway Traffic Interchange
Alternative 1 – No Build Alternative
Alternative 2 – Roundabout Modifications
Alternative 3 – Great Western Drive TI & with No-Build
Alternative 4 – Great Western Drive TI & Minimal Roundabout Modifications

Glassford Hill Road Traffic Interchange
Alternative 1 – No Build Alternative
Alternative 2– Signal Optimization & Minimal lane adjustment (southbound free right)
Alternative 3 – Diverging Diamond Interchange
Alternative 4 –Roundabout Interchange
Alternative 5 – Great Western Drive TI & Signal Modifications (Alt 2)
Alternative 6 – Great Western Drive TI & Roundabout Interchange (Alt 4)

Robert Road Intersection
Alternative 1 – No Build Alternative
Alternative 2 – Intersection Signal Improvements
Alternative 3 – Two-Lane Roundabout
Alternative 4 – Three-Lane Roundabout
Alternative 5 – Traffic Interchange

For each location the No-Build Alternative includes the existing SR 89A corridor, interchanges, and intersections and any planned improvements that currently have secured construction funding through either state, regional, county, or local funding mechanism.

Traffic operational analysis were conducted for each Alternative following the methodologies described in Working Paper #1, Section 3.3.5. Rodel traffic software was utilized in the analysis of all roundabouts. Year 2040 build traffic projections were developed based upon the 2040 no-build volumes and manually adjusted to account for redistribution where new access points to the corridor are present in each alternative. A predictive safety detailed analysis was conducted for each alternative; a memorandum describing this analysis is included in **Appendix 2**.

The alternatives analysis includes evaluation of each of the alternatives using the evaluation criteria and weighting factors as described in Section 3. The evaluation criteria was analyzed for each alternative at all three locations. The alternative receiving the highest score at each respective location is identified as the preferred 2040 alternative. The alternative analysis matrices for the Granite Dells Parkway TI, Glassford Hill Road TI, and Robert Road intersection locations are shown in **Table 4**, **Table 5**, and **Table 6,** respectively.

5.2 Alternative Analysis Recommendations

Based upon the analysis as described in the following tables, the preferred 2040 Alternative at Granite Dells Parkway is to keep the existing roundabout with minimal lane configuration adjustments as well as implement the Great Western Drive TI. The preferred 2040 Alternative at Glassford Hill Road TI is to also implement the Great Western Drive TI west of Glassford Hill Road as well as convert the existing signalized intersections into roundabouts. The preferred 2040 Alternative at the Robert Road intersection is to implement the Robert Road Traffic Interchange, configured east of the existing Robert Road intersection.

Table 4: Granite Dells Parkway TI Alternative Matrix

EVALUATION CRITERIA		NO-BUILD	ROUNDABOUT MODIFICATIONS	GREAT WESTERN DR TI W/ NO-BUILD	GREAT WESTERN DR TI W/ MINIMAL ROUNDABOUT MODIFICATION
Safety	**Conflict Points**	• 12 vehicular conflicts • 8 pedestrian conflicts *Net Effect: 5*	• 12 vehicular conflicts • 8 pedestrian conflicts *Net Effect: 5*	• 12 vehicular conflicts • 8 pedestrian conflicts *Net Effect: 5*	• 12 vehicular conflicts • 8 pedestrian conflicts *Net Effect: 5*
	Predictive Safety Analysis	• No crashes at location *Net Effect: 4*	• Qualitative: Increasing through lane, adding reverse curvature to entrance *Net Effect: 4*	• New conflict points introduced *Net Effect: 3*	• New conflict points introduced *Net Effect: 3*
Mobility/Constructability	**Level of Service**	• 2040 Intersection – AM LOS F, PM LOS D *Net Effect: 1*	• 2040 Intersection – AM LOS A, PM LOS C (Appr) Net Effect: 3	• 2040 Intersection – AM LOS C (Appr), PM LOS A Net Effect: 3	• 2040 Intersection – AM LOS A , PM LOS A • Net Effect: 5
	Constructability/Maintenance of Traffic	• No Issues *Net Effect: 5*	• New lane addition *Net Effect: 4*	• Traffic Control Complex *Net Effect: 3*	• Traffic Control Complex *Net Effect: 3*
Regional Acceptance & Impacts	**Consistency With Plans**	• N/A *Net Effect: 3*	• Not include in plans *Net Effect: 3*	• Included in multiple plans *Net Effect: 5*	• Included in multiple plans *Net Effect: 5*
	Agency & Public Acceptance				
	ROW Acquisition Displacements	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*
	Protected Populations	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*
Utility Impacts		• None *Net Effect: 3*	• No anticipated impacts *Net Effect: 3*	• No anticipated impacts *Net Effect: 3*	• No anticipated impacts *Net Effect: 3*
Project Costs Construction	**Construction**	• None *Net Effect: 3*	• Lane modifications • $600k *Net Effect: 2*	• TI construction • $20 million *Net Effect: 1*	• TI construction • Lane Modifications • $20.3 million *Net Effect: 1*
	Operations & Maintenance	• Lighting maintenance *Net Effect: 4*	• Lighting maintenance *Net Effect: 4*	• Lighting maintenance • TI maintenance *Net Effect: 2*	• Lighting maintenance • TI maintenance *Net Effect: 2*
	Right-of-Way (acres)	• None *Net Effect: 3*	• None *Net Effect: 3*	• 2 acres *Net Effect: 2*	• 2 acres *Net Effect: 2*
Criteria Rating **1 – Strong Disadvantage** **2 – Some Disadvantage** **3 - Neutral** **4 – Some Advantage** **5 – Strong Advantage**		***Draft Total Net Effect: 42.4*** ****Tentative agency and public acceptance input***	***Draft Total Net Effect: 44.2*** ****Tentative agency and public acceptance input***	***Draft Total Net Effect: 44.2*** ****Tentative agency and public acceptance input***	***Draft Total Net Effect: 45.6*** ****Tentative agency and public acceptance input***

Table 5: Glassford Hill Road TI Alternative Matrix

EVALUATION CRITERIA		NO-BUILD	SIGNAL OPTIMIZATION W/ FREE RIGHT	DIVERGING DIAMOND INTERCHANGE	ROUNDABOUT INTERCHANGE	GREAT WESTERN DR TI W/ SIGNAL OPT	GREAT WESTERN DR TI WROUNDABOUT INTERCHANGE
Safety	**Conflict Points**	• 26 vehicular conflicts • 20 pedestrian conflicts *Net Effect: 2*	• 26 vehicular conflicts • 20 pedestrian conflicts *Net Effect: 2*	• 14 vehicular conflicts • 12 pedestrian conflicts *Net Effect: 4*	• 12 vehicular conflicts • 8 pedestrian conflicts *Net Effect: 5*	• 26 vehicular conflicts • 20 pedestrian conflicts *Net Effect: 2*	• 12 vehicular conflicts • 8 pedestrian conflicts *Net Effect: 5*
	Predictive Safety Analysis	• none *Net Effect: 2*	• 0.2 total crash reduction • 0.1 injury crash reduction *Net Effect: 3*	• 1.9 total crash reduction • 0.5 injury crash reduction *Net Effect: 5*	• 1.1 total crash reduction • 0.9 injury crash reduction *Net Effect: 5*	• New conflict points introduced *Net Effect: 2*	• New conflict points introduced *Net Effect: 3*
Mobility/Constructability	**Level of Service**	• 2040 Intersection – AM LOS F, PM LOS F *Net Effect: 1*	• 2040 Intersection – AM LOS F, PM LOS D (Appr.) *Net Effect: 2*	• 2040 Intersection – AM LOS F, PM LOS B *Net Effect: 3*	• 2040 Intersection – AM LOS F, PM LOS D (appr) *Net Effect: 2*	• 2040 Intersection – AM LOS F, PM LOS C *Net Effect: 2*	• 2040 Intersection – AM LOS A, PM LOS A *Net Effect: 5*
	Constructability/ Maintenance of Traffic	• No Issues *Net Effect: 5*	• Minimal Impacts to Traffic *Net Effect: 4*	• Traffic Control more complex *Net Effect: 1*	• Traffic Control more complex *Net Effect: 2*	• Traffic Control Complex *Net Effect: 3*	• Traffic Control more complex *Net Effect: 2*
Regional Acceptance & Impacts	**Consistency With Plans**	• N/A *Net Effect: 3*	• Not include in plans *Net Effect: 3*	• Not included in plans or implemented in district *Net Effect: 2*	• Not include in plans *Net Effect: 3*	• Included in multiple plans *Net Effect: 5*	• Included in multiple plans *Net Effect: 4*
	Agency & Public Acceptance	*Net Effect: 0*		*Net Effect: 0*			
	ROW Acquisition Displacements	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*
	Protected Populations	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*
Utility Impacts		• None *Net Effect: 3*	• No anticipated impacts *Net Effect: 3*	• potential impacts (waterline) *Net Effect: 2*	• potential impacts (waterline) *Net Effect: 2*	• No anticipated impacts *Net Effect: 3*	• potential impacts (waterline) *Net Effect: 2*
Project Costs Construction	**Construction**	• None *Net Effect: 3*	• Signal modification, Additional turn lane • $300k *Net Effect: 3*	• DDI construction • $3.3 million *Net Effect: 2*	• Roundabout construction • $5.6 million *Net Effect: 2*	• TI construction, signal modification • $20.3 million *Net Effect: 1*	• TI construction, roundabout construction • $25.6 million *Net Effect: 1*
	Operations & Maintenance	• Signal maintenance *Net Effect: 3*	• Signal maintenance *Net Effect: 3*	• Signal maintenance *Net Effect: 3*	• Roundabout lighting *Net Effect: 4*	• Signal maintenance • TI maintenance *Net Effect: 1*	• Roundabout lighting • TI maintenance *Net Effect: 2*
	Right-of-Way (acres)	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• 2 acres *Net Effect: 2*	• 2 acres *Net Effect: 2*
Criteria Rating **1 – Strong Disadvantage** **2 – Some Disadvantage** **3 - Neutral** **4 – Some Advantage** **5 – Strong Advantage**		***Draft Total Net Effect: 34*** ****Tentative agency and public acceptance input***	***Draft Total Net Effect: 38.4*** ****Tentative agency and public acceptance input***	***Draft Total Net Effect: 35.2*** ****Tentative agency and public acceptance input***	***Draft Total Net Effect: 39.6*** ****Tentative agency and public acceptance input***	***Draft Total Net Effect: 34.2*** ****Tentative agency and public acceptance input***	***Draft Total Net Effect: 41*** ****Tentative agency and public acceptance input***

Table 6: Robert Road Intersection Alternative Matrix

EVALUATION CRITERIA		NO-BUILD	INTERSECTION SIGNAL IMPROVEMENTS	2-LANE ROUNDABOUT	3-LANE ROUNDABOUT	TRAFFIC INTERCHANGE
Safety	**Conflict Points**	• 32 vehicular conflicts • 16 pedestrian conflicts *Net Effect: 2*	• 32 vehicular conflicts • 16 pedestrian conflicts *Net Effect: 2*	• 8 vehicular conflicts • 8 pedestrian conflicts *Net Effect: 5*	• 8 vehicular conflicts • 8 pedestrian conflicts *Net Effect: 5*	• 26 vehicular conflicts • 20 pedestrian conflicts *Net Effect: 3*
	Predictive Safety Analysis	• none *Net Effect: 1*	• 0.6 total crash reduction *Net Effect: 2*	• 0.8 total crash reduction • 1.7 injury crash reduction *Net Effect: 5*	• 0.8 total crash reduction* • 1.7 injury crash reduction *Net Effect: 4*	• 1.2 total crash reduction • 0.7 injury crash reduction *Net Effect: 4*
Mobility/Constructability	**Level of Service**	• 2040 Intersection – AM LOS F, PM LOS E *Net Effect: 1*	• 2040 Intersection – AM LOS D (Appr), PM LOS F *Net Effect: 2*	• 2040 Intersection – AM LOS F, PM LOS F *Net Effect: 1*	• 2040 Intersection – AM LOS B, PM LOS D (Appr) *Net Effect: 3*	• 2040 Intersection – AM LOS C (Appr), PM LOS C *Net Effect: 4*
	Constructability/Maintenance of Traffic	• No Issues *Net Effect: 5*	• Minimal Impacts to Traffic *Net Effect: 4*	• Traffic Control more complex *Net Effect: 2*	• Traffic Control more complex *Net Effect: 2*	• Traffic Control Complex *Net Effect: 3*
Regional Acceptance & Impacts	**Consistency With Plans**	• N/A *Net Effect: 3*	• Partially included in plan *Net Effect: 4*	• Not include in plans *Net Effect: 3*	• Not include in plans *Net Effect: 3*	• Included in multiple plans *Net Effect: 5*
	Agency & Public Acceptance					
	ROW Acquisition Displacements	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*
	Protected Populations	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*
Utility Impacts		• None *Net Effect: 3*	• No anticipated impacts *Net Effect: 3*	• No anticipated impacts *Net Effect: 3*	• No anticipated impacts *Net Effect: 3*	• Potential impacts (overhead powerline) *Net Effect: 2*
Project Costs Construction	**Construction**	• None *Net Effect: 3*	• Signal modification, Additional turn lane • $2.97 million *Net Effect: 2*	• Roundabout construction • $4.5 million *Net Effect: 2*	• Roundabout construction • $5.4 million *Net Effect: 2*	• TI construction • $30.4 million *Net Effect: 1*
	Operations & Maintenance	• Signal maintenance *Net Effect: 3*	• Signal maintenance *Net Effect: 3*	• Roundabout lighting *Net Effect: 4*	• Roundabout lighting *Net Effect: 4*	• Multiple signal maintenance *Net Effect: 2*
	Right-of-Way (acres)	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• None *Net Effect: 3*	• 14 acres *Net Effect: 1*
Criteria Rating **1 – Strong Disadvantage** **2 – Some Disadvantage** **3 - Neutral** **4 – Some Advantage** **5 – Strong Advantage**		***Draft Total Net Effect: 32.8*** ****Tentative agency and public acceptance input***	***Draft Total Net Effect: 35.6*** ****Tentative agency and public acceptance input***	***Draft Total Net Effect: 42*** ****Tentative agency and public acceptance input***	***Draft Total Net Effect: 39.4*** ****Tentative agency and public acceptance input***	***Draft Total Net Effect: 42.4*** ****Tentative agency and public acceptance input***

* No crash modification factor available specifically for a 3-lane roundabout (more crashes are expected to occur as compared to a two-lane roundabout)

6.0 Alternatives Analysis & Recommendations

6.1 Introduction

Based on the results of the Alternative Evaluation, safety needs, and no-build operational analysis, a list of longer term 2040 Build Recommendations was developed. Conceptual 15% design plans will be prepared for this Recommended Build Alternative in the Draft Final Report.

6.2 2040 Build Recommendations

The long term 2040 Build Recommendations that are recommended for implementation in the long-term include the following:

SR 89A Mainline

- Additional general purpose lane

SR 89 TI

- Additional eastbound left-turn lane
- Eastbound entrance ramp reconfiguration (two lane entrance ramp)

Granite Dells Parkway TI

- Minimal roundabout modifications

Great Western Drive

- Traffic Interchange

Glassford Hill Road TI

- Westbound extended parallel entrance ramp
- Roundabout Interchange

Viewpoint Drive TI

- Westbound entrance ramp extension
- Additional northbound lane and eastbound exit ramp dual left-turn

Robert Road Intersection

- Traffic Interchange

Intersection lane configuration, mainline volumes, and intersection volumes for the 2040 Build Recommendations are displayed in **Figure 20**, **Figure 21**, and **Figure 22**, respectively.

6.3 2040 Build Recommended Alternative Operational Analysis Results

SR 89A Mainline and Ramp Results

Figure 23 and **Figure 24** summarize the level-of-service analysis results for the 2040 Recommended Build Alternative during both the AM and PM peak hours, respectively, on the SR 89A mainline.

In the AM peak Hour, SR 89A operates at LOS 'C' or better in both the eastbound and westbound directions of travel. The following ramp operates with a LOS 'E' or worse:

- SR 89 westbound off-ramp

In the PM peak Hour, SR 89A operates at LOS 'D' or better in the eastbound direction of travel for all segments with the exception of the segment between Glassford Hill entrance ramp to the Viewpoint Drive exit ramp which operates at a LOS 'E'. The westbound direction of travel operates at a LOS 'E or F' from the Granite Dells Parkway entrance ramp until the SR 89 exit ramp. All other segments operate at a LOS 'C' or better.

The following ramps operate with a LOS 'E' or worse:

- SR 89 westbound off-ramp
- Viewpoint Drive eastbound off-ramp

Intersection Results

Figure 25 includes the operational results for the 2040 Recommended Build Alternative. In the AM peak hour, the following intersections are anticipated to operate at a LOS 'E or F':

- SR 89A/SR 89 TI

In the PM peak hour, the following intersections are anticipated to degrade and operate at a LOS 'E or F':

- SR 89A/SR 89 TI

In the PM peak hour, the following intersections are anticipated to operate at a LOS 'E or F' on at least one approach but operate at a LOS 'D' or better as a total intersection:

- SR 89A/Viewpoint Road

Figure 20: 2040 Build Recommended Roadway Features

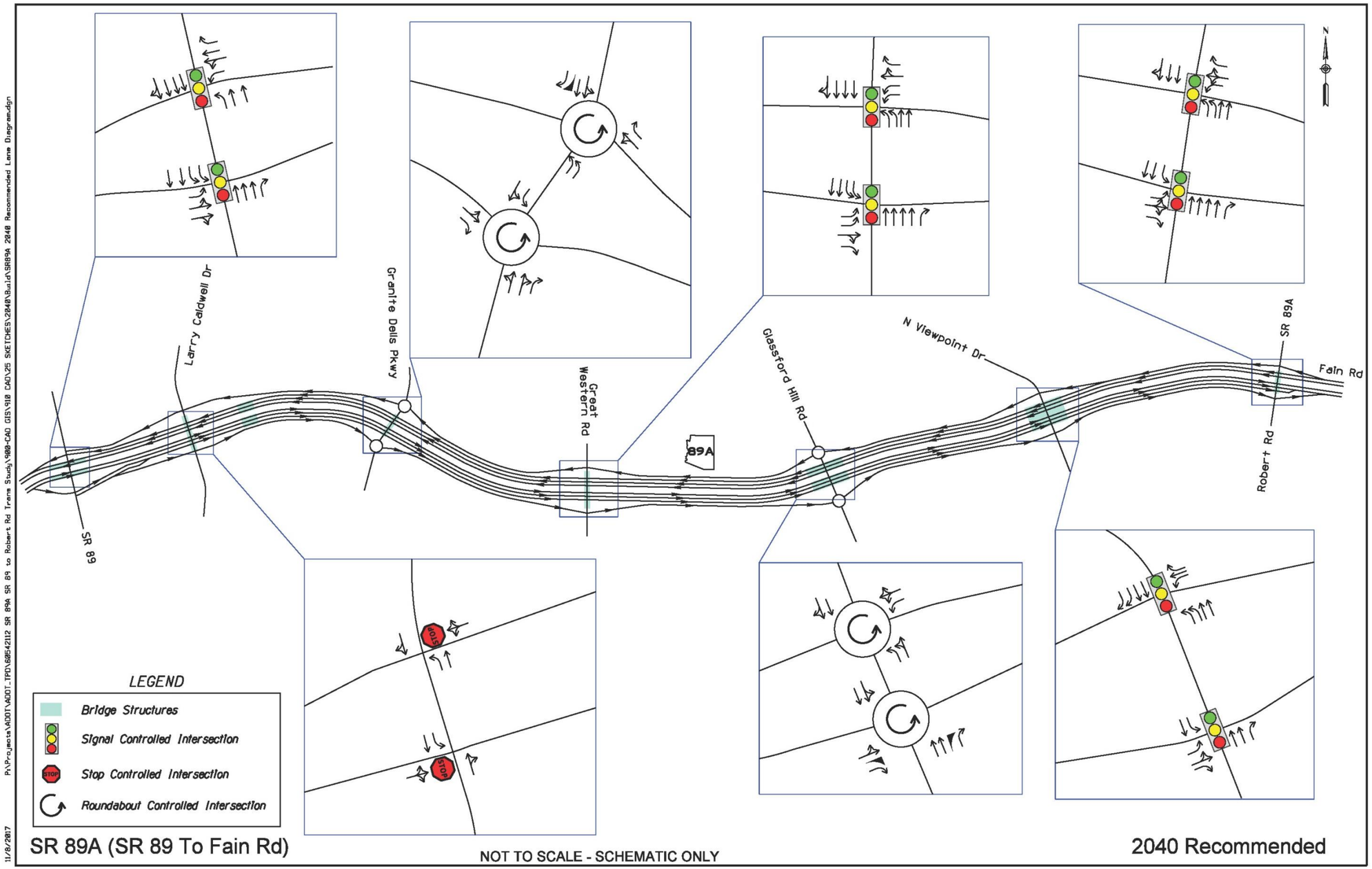


Figure 21: 2040 Build Recommended SR 89A Mainline Lane Configuration and Volumes

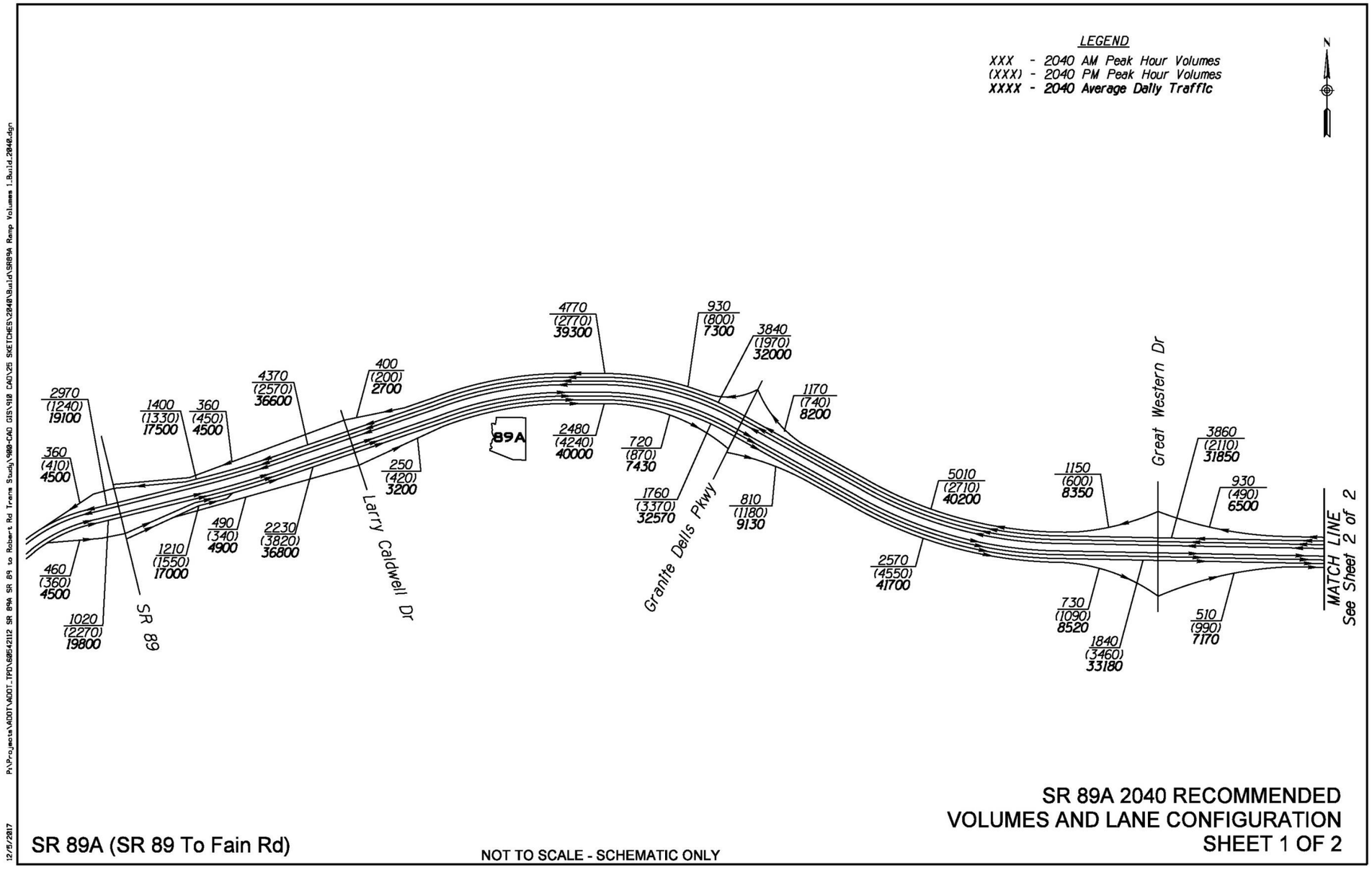


Figure 21 (cont'd): 2040 Build Recommended SR 89A Mainline Lane Configuration and Volumes

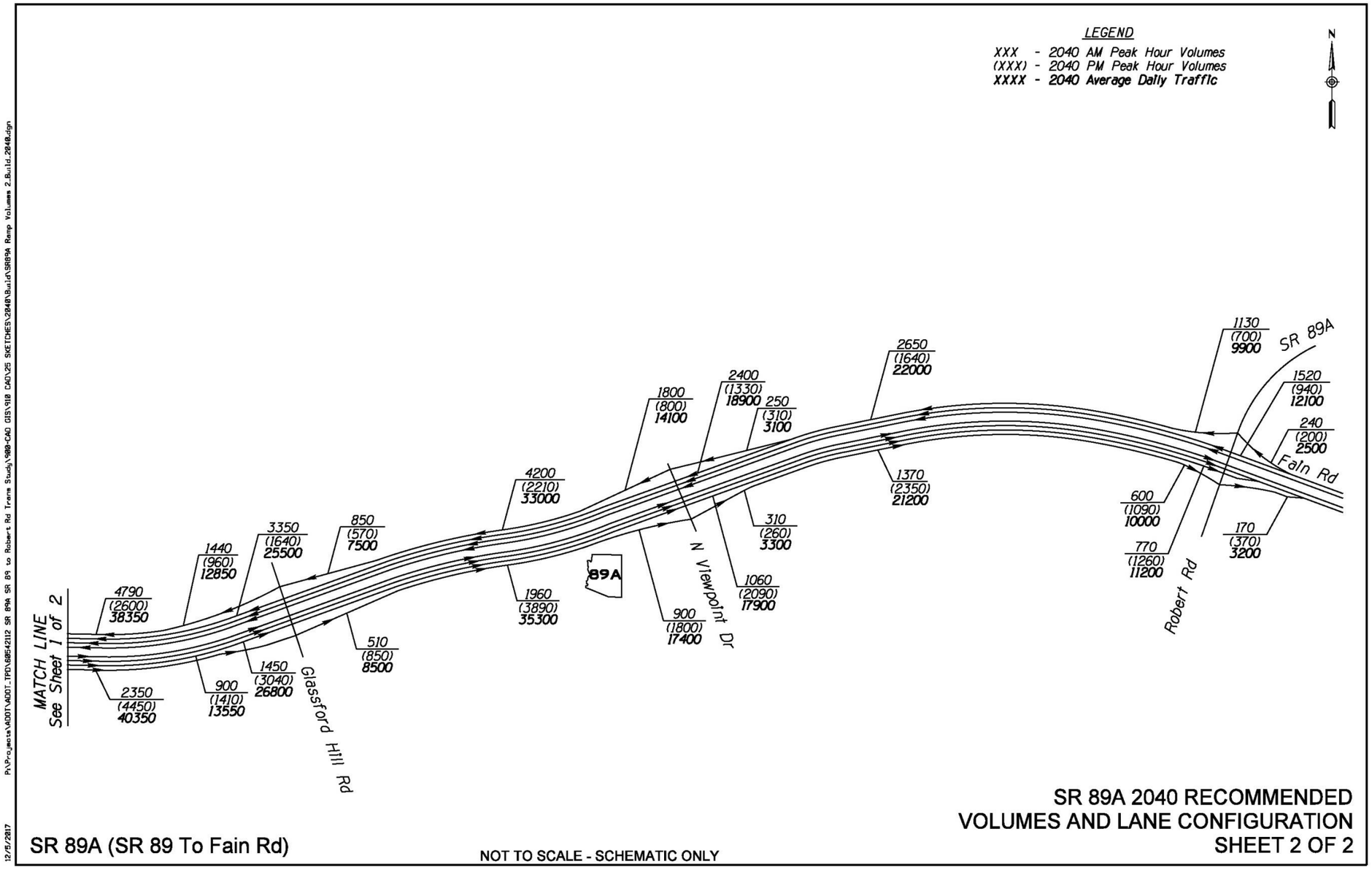


Figure 22: 2040 Build Recommended Intersection Turning Movement Volumes

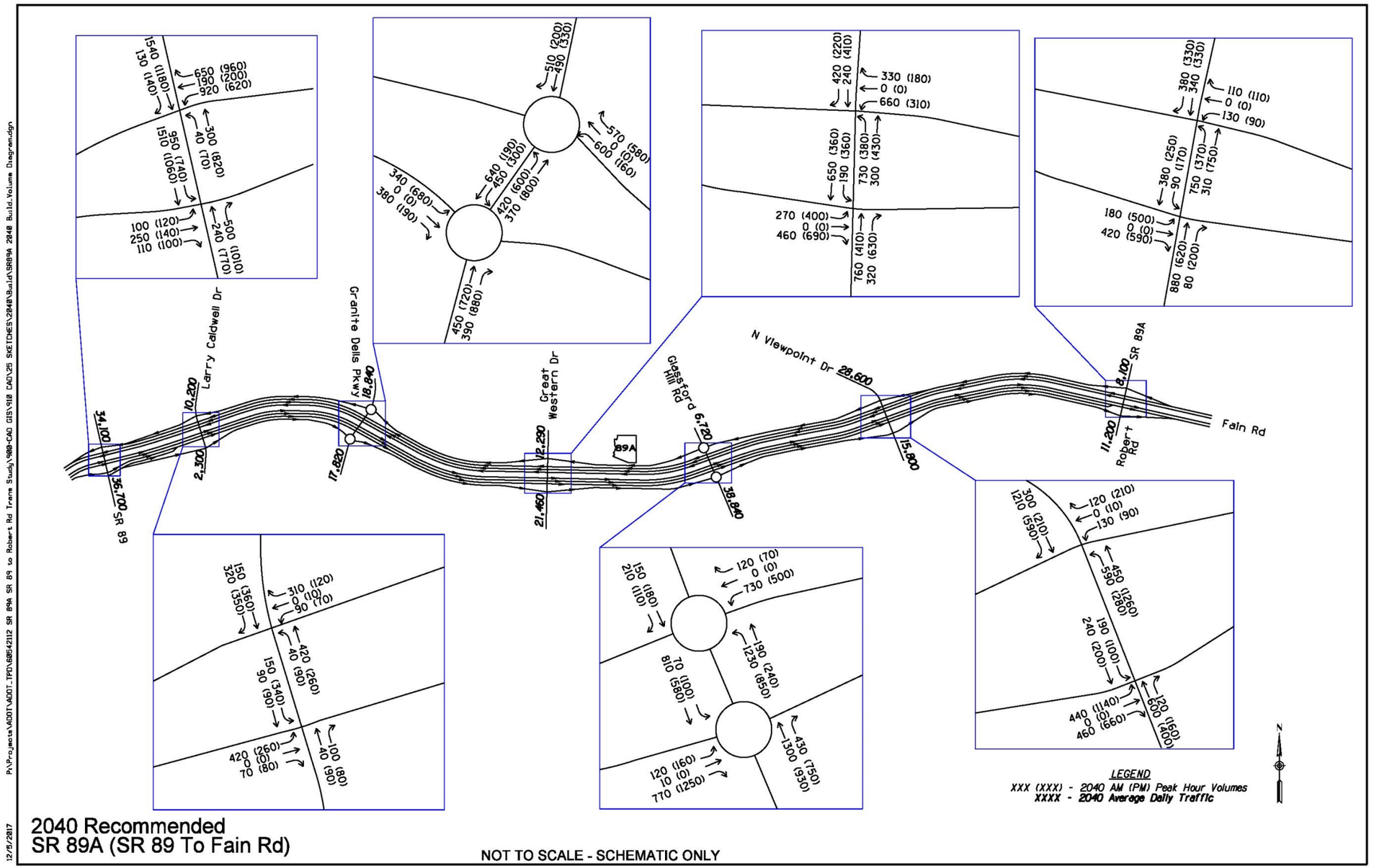


Figure 23: 2040 Build Recommended AM Peak Hour Level-of-Service on SR 89A Mainline and Ramps

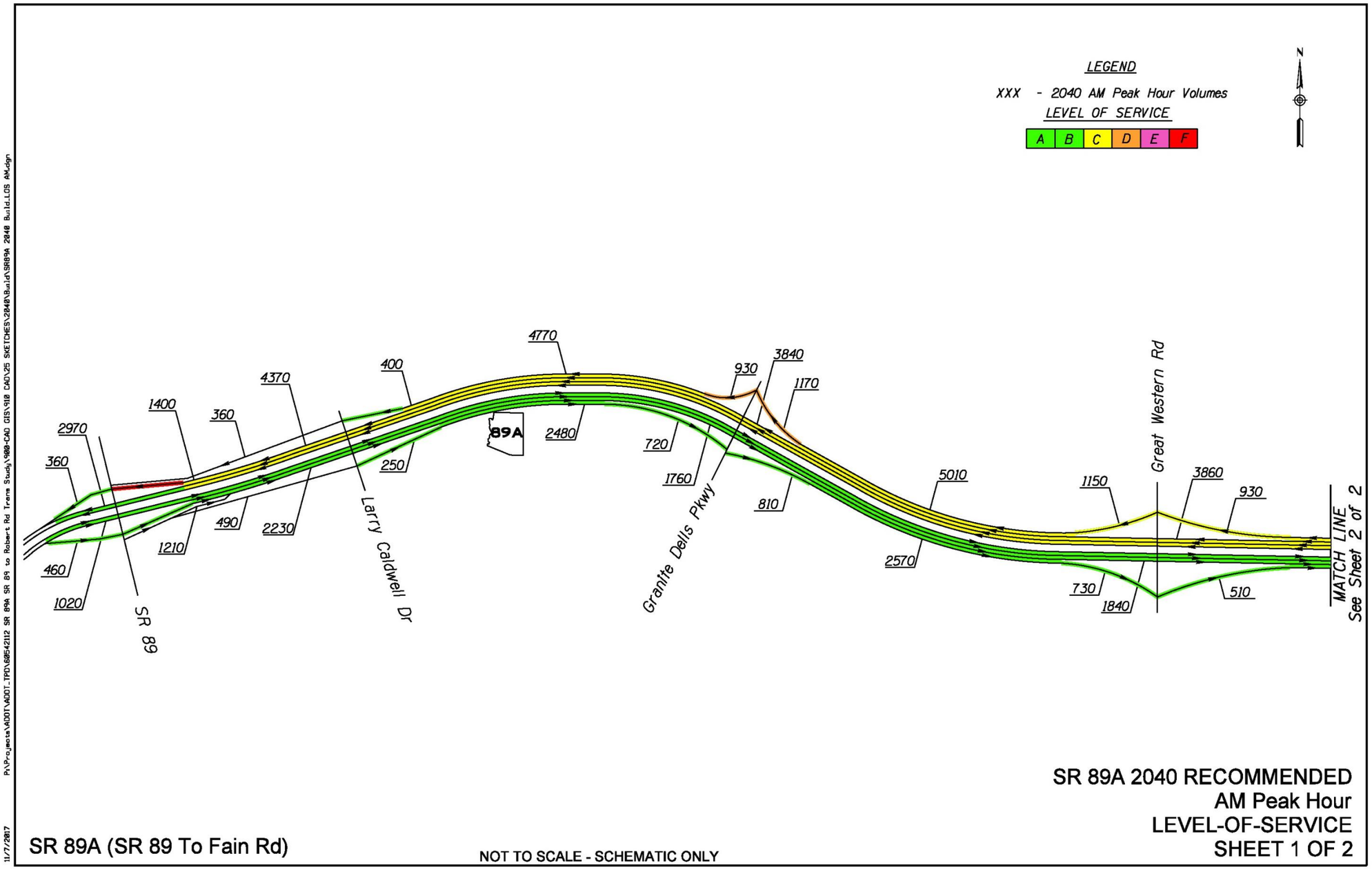


Figure 23 (cont'd): 2040 Build Recommended AM Peak Hour Level-of-Service on SR 89A Mainline and Ramps

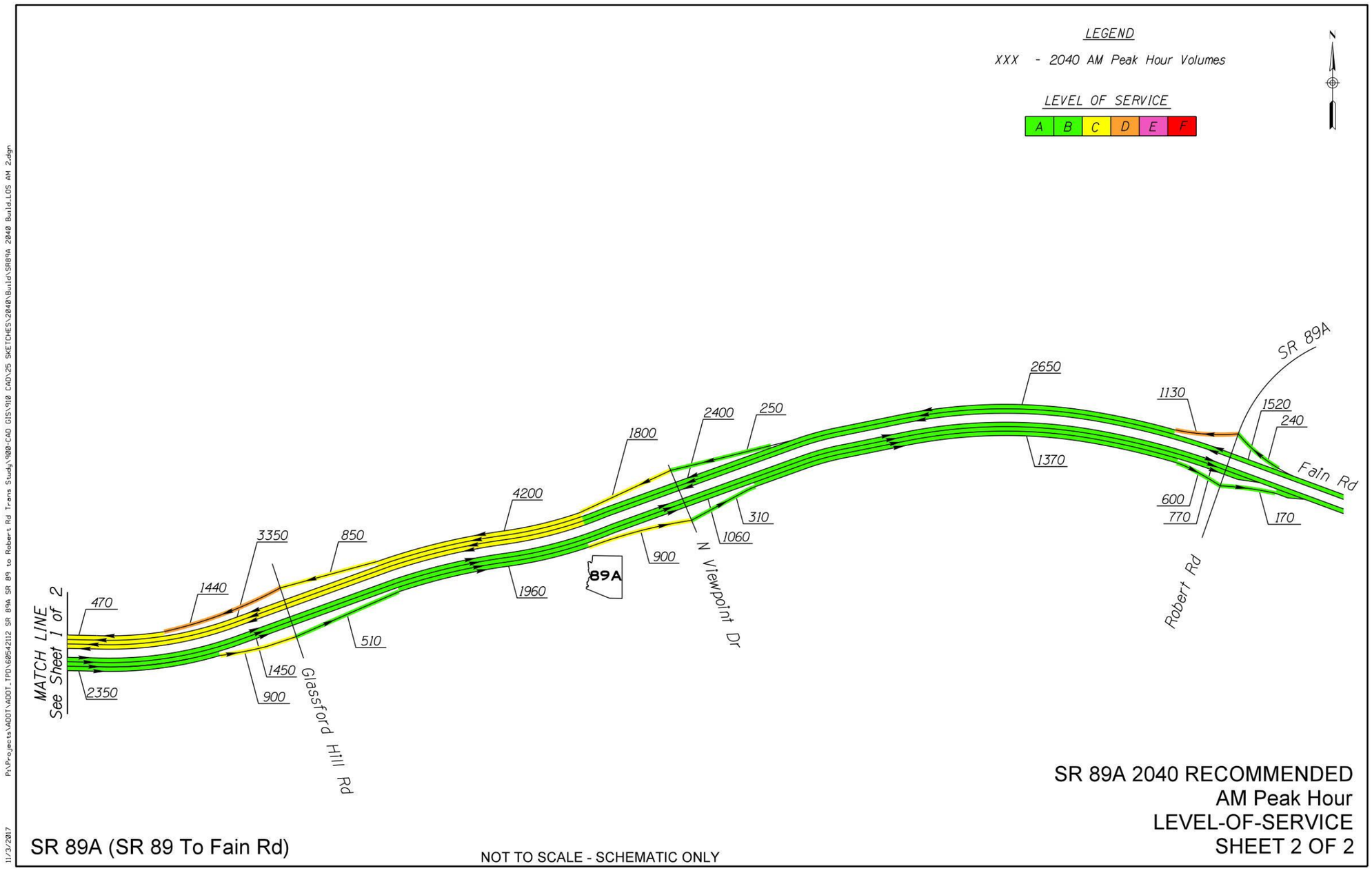


Figure 24: 2040 Build Recommended PM Peak Hour Level-of-Service on SR 89A Mainline and Ramps

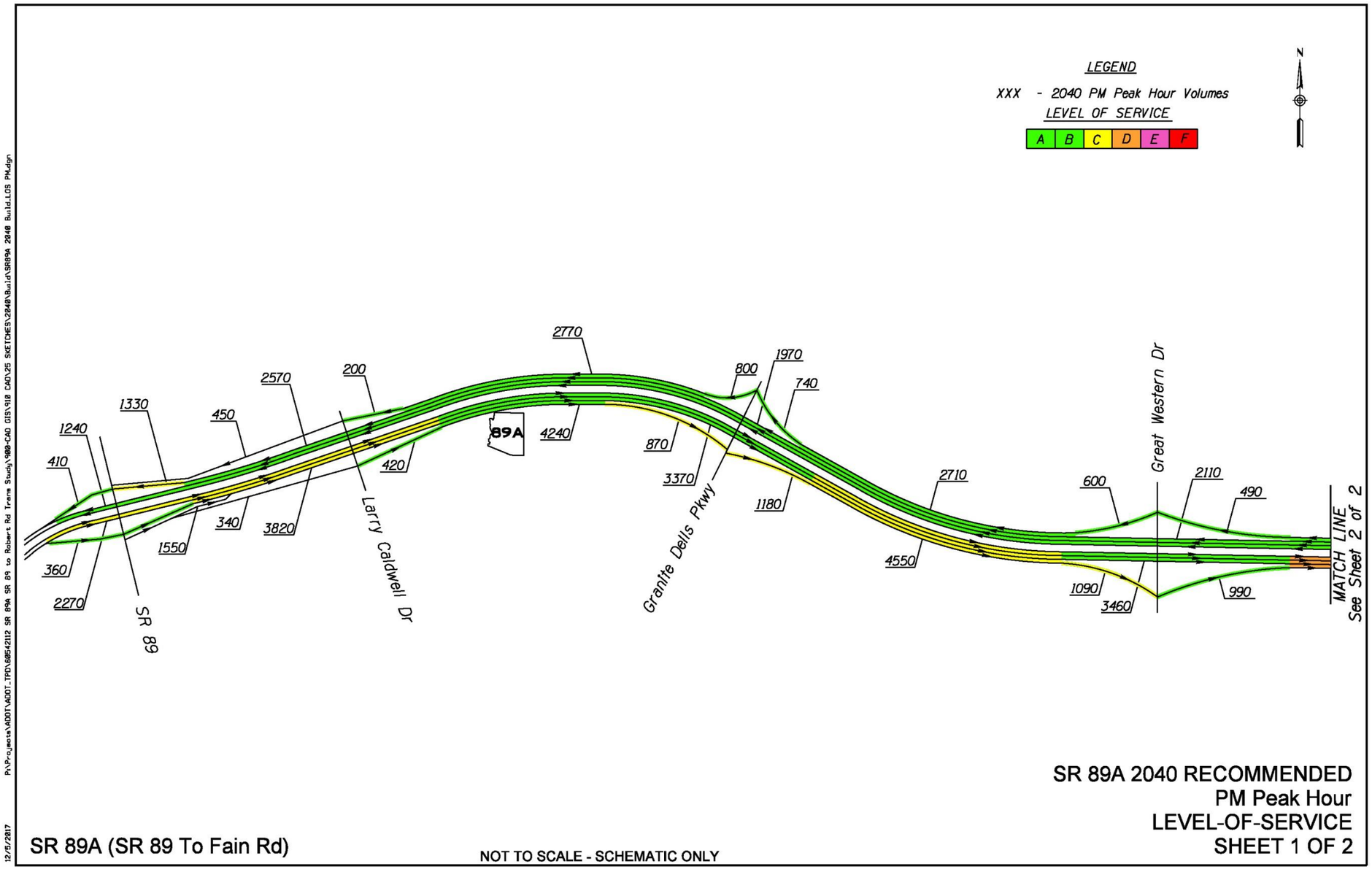


Figure 24 (cont'd): 2040 Build Recommended PM Peak Hour Level-of-Service on SR 89A Mainline and Ramps

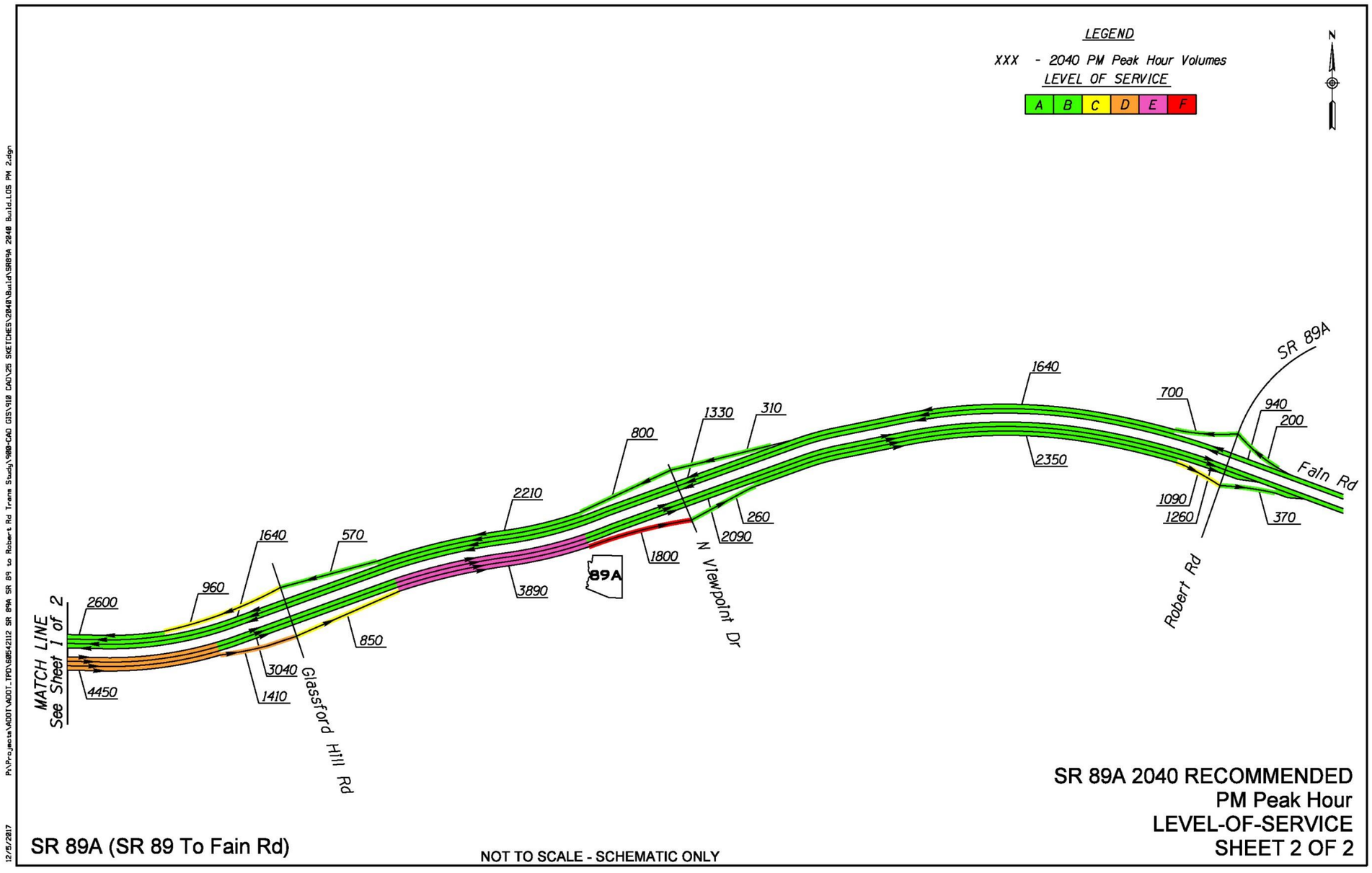
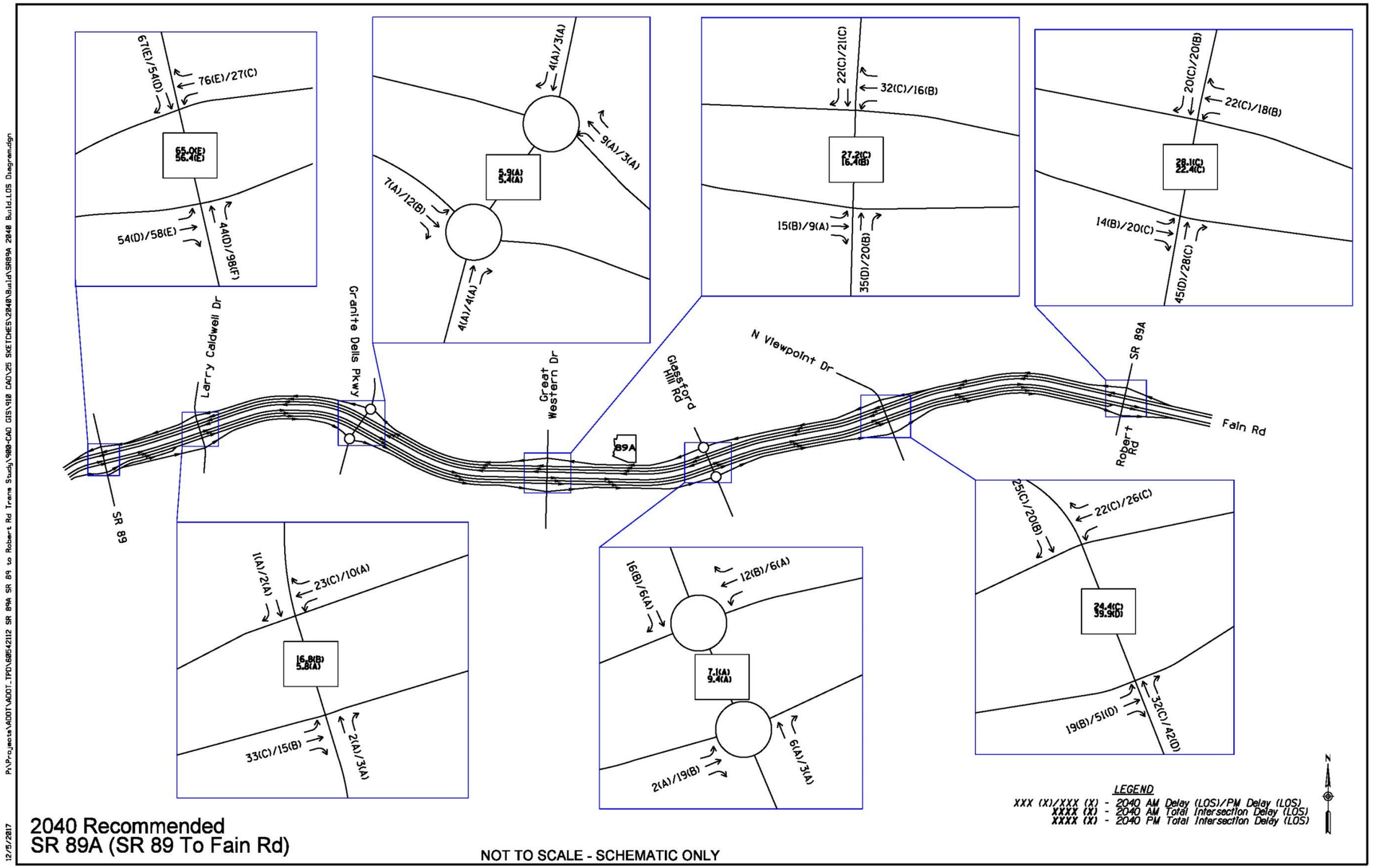


Figure 25: 2040 Build Recommended Intersection Level-of-Service



7.0 Implementation Plan

7.1 Introduction

Based upon the incremental needs analysis for the no-build conditions, safety analysis, core team input, and the 2040 Build Recommended Alternative, an implementation plan of short-term, mid-term, and long-term projects were developed. These short-term, mid-term, and long-term solutions were correlated to the years 2025, 2030-2035, and 2040 respectively. The implementation period of the projects was determined through the combination of a traffic operational analysis and safety analysis. The safety analysis was performed at locations of safety concern which were determined during the current condition assessment of the study corridor. A predictive safety analysis was performed, enabling the development of crash reduction factors for specific geometric improvements that provide a safety benefit to roadway users. Additionally, utilizing traffic modeling to assess future traffic conditions at each implementation period, the level-of-service failures were identified and further assessed following the implementation of roadway improvements.

The project implementation includes the ultimate corridor improvements as identified in the 2040 Build Recommended Improvements included in Section 6, safety improvements, as well as interim solutions.

7.2 Short-term Implementation (2025)

The short-term 2025 Build Recommendations that are recommended for implementation include the following:

SR 89 TI

- Additional eastbound left-turn lane
- Eastbound entrance ramp reconfiguration (two lane entrance ramp)

Great Western Drive

- Interim access closure

Glassford Hill Road TI

- Westbound extended parallel entrance ramp
- Eastbound exit ramp free right-turn lane

Viewpoint Drive TI

- Westbound entrance ramp extension
  - Additional northbound lane and eastbound exit ramp dual left-turn

Robert Road Intersection

- Interim signalized intersection improvements

Intersection lane configurations for the 2025 Build Recommendations are displayed in **Figure 26**.

7.3 Mid-Term Implementation (2030)

The mid-term 2025 Build Recommendations that are recommended for implementation include the following:

SR 89A Mainline

- Additional general purpose lane in both the eastbound and westbound direction of travel between the SR 89 TI and Glassford Hill Road TI

Glassford Hill Road TI

- Roundabout Interchange

Robert Road Intersection

- Traffic Interchange
- Construct all critical connecting accesses to the new alignment of Robert Road

Intersection lane configurations for the 2030 Build Recommendations are displayed in **Figure 27**.

7.4 Mid-Term Implementation (2035)

The mid-term 2035 Build Recommendations that are recommended for implementation include the following:

Great Western Drive TI

- Traffic Interchange

Intersection lane configurations for the 2035 Build Recommendations are displayed in **Figure 28**.

7.5 Long-Term Implementation (2040)

The remaining long-term 2040 Build Recommendations that are recommended for implementation include the following:

SR 89A Mainline

- Additional general purpose lane in both the eastbound and westbound direction between the Glassford Hill Road TI and Robert Road TI

Granite Dells Parkway TI

- Minimal roundabout modifications

7.6 Implementation Operational Analysis Results

An operational analysis was performed for the mainline including the general-purpose lanes, ramp junctions, and weave sections and for the build conditions for each of the horizon years. Intersection analysis was also performed for the study intersections including the five TI's and one at-grade signalized intersection. This levels-of-service (LOS) analysis was conducted following the methodologies described in Working Paper #1, Section 3.3.5. **Table 7** and **Table 8** include the anticipated Build Recommended Alternatives Year 2025, 2030, and 2035 LOS results during the AM and PM Peak Hours for the intersections, respectively. **Table 9** includes the anticipated Build Recommended Alternatives Year 2025, 2030, and 2035 LOS results during the AM and PM Peak hours for the mainline. These tables also include the existing 2017 and 2040 Build Recommended results for comparison purposes. **Appendix 3** includes visual representation of the volumes and results for the 2025 – 2035 Years.

The following summarizes the results of each facility over time for the recommended build conditions:

SR 89A Eastbound Mainline – With the implementation of recommendations, the eastbound SR 89A mainline operates at LOS C or better through 2040 in the AM peak hour. In the PM peak hour, the eastbound mainline operates at LOS E by Year 2040 between the Glassford Hill entrance ramp and the Viewpoint Drive exit ramp, and at LOS D or better in all other segments.

SR 89A Westbound Mainline – With the implementation of recommendations, the eastbound SR 89A mainline operates at LOS C or better through 2040 in the AM peak hour. In the PM peak hour, the westbound mainline operates at LOS F by Year 2040 between the Granite Dells entrance ramp and the SR 89 exit ramp and at LOS A in all other segments.

SR 89 Traffic Interchange – The signalized intersection of SR 89A Ramps and SR 89 begins to degrade in the AM peak hour by Year 2040, by which time the intersection overall operates at LOS E. In the PM peak hour, one approach of this interchange begins to operate at LOS E by Year 2025. By Year 2030, the overall intersection operates at LOS E, and by Year 2035 at LOS F.

Larry Caldwell Drive Traffic Interchange – The stop-controlled intersection of SR 89A Ramps and Larry Caldwell Drive operates at LOS B or better, with every approach operating at LOS D or better through Year 2040 in both the AM and PM peak hours.

Granite Dells Parkway Traffic Interchange – The roundabout intersections at SR 89A Ramps and Granite Dells Parkway operate at LOS A, with every approach operating at LOS D or better through Year 2040 in both the AM and PM peak hours.

Great Western Drive Traffic Interchange – The recommendations include construction of the Great Western Drive Traffic Interchange between Granite Dells Parkway and Glassford Hill Road by 2035. The signal-controlled intersection of SR 89A Ramps and Great Western Drive operates at LOS C or better, with every approach operating at LOS D or better through Year 2040 in both the AM and PM peak hours.

Glassford Hill Road Traffic Interchange – The recommendations include providing roundabout intersections at SR 89A Ramps and Glassford Hill Road by Year 2030. With this recommendation, the intersection operates at LOS C or better, with every approach operating at LOS D or better through Year 2040 in both the AM and PM peak hours.

Viewpoint Drive Traffic Interchange – The signalized intersection of SR 89A Ramps and Viewpoint Drive operates at LOS D or better, with every approach operating at LOS D or better through Year 2040 in both the AM peak hour. In the PM peak hour, the eastbound approach to the intersection degrades to LOS E by Year 2040.

Robert Road/Fain Road Intersection – The recommendations at SR 89A, Robert Road, and Fain Road include converting the intersection to a traffic interchange by Year 2035. With these recommendations, the intersection operates at LOS C or better, with every approach operating at LOS C or better through Year 2040 in both the AM and PM peak hours.

7.7 Funding

The proposed recommendations, as described in Chapters 6 and 7 of this study, do not have secured funding nor are programmed in any state, regional, or local jurisdictional programming document to date.

Selected recommendations will be further developed into 15% design plans as a component of the final report.

Based on the scope of work and benefit towards the system's mobility and/or safety, certain projects may be eligible for additional funding sources, such as Highway Safety Improvement Program funds, in addition to federal, state, and local funding sources with traditional allocations.

Figure 26: 2025 Build Recommended Roadway Features

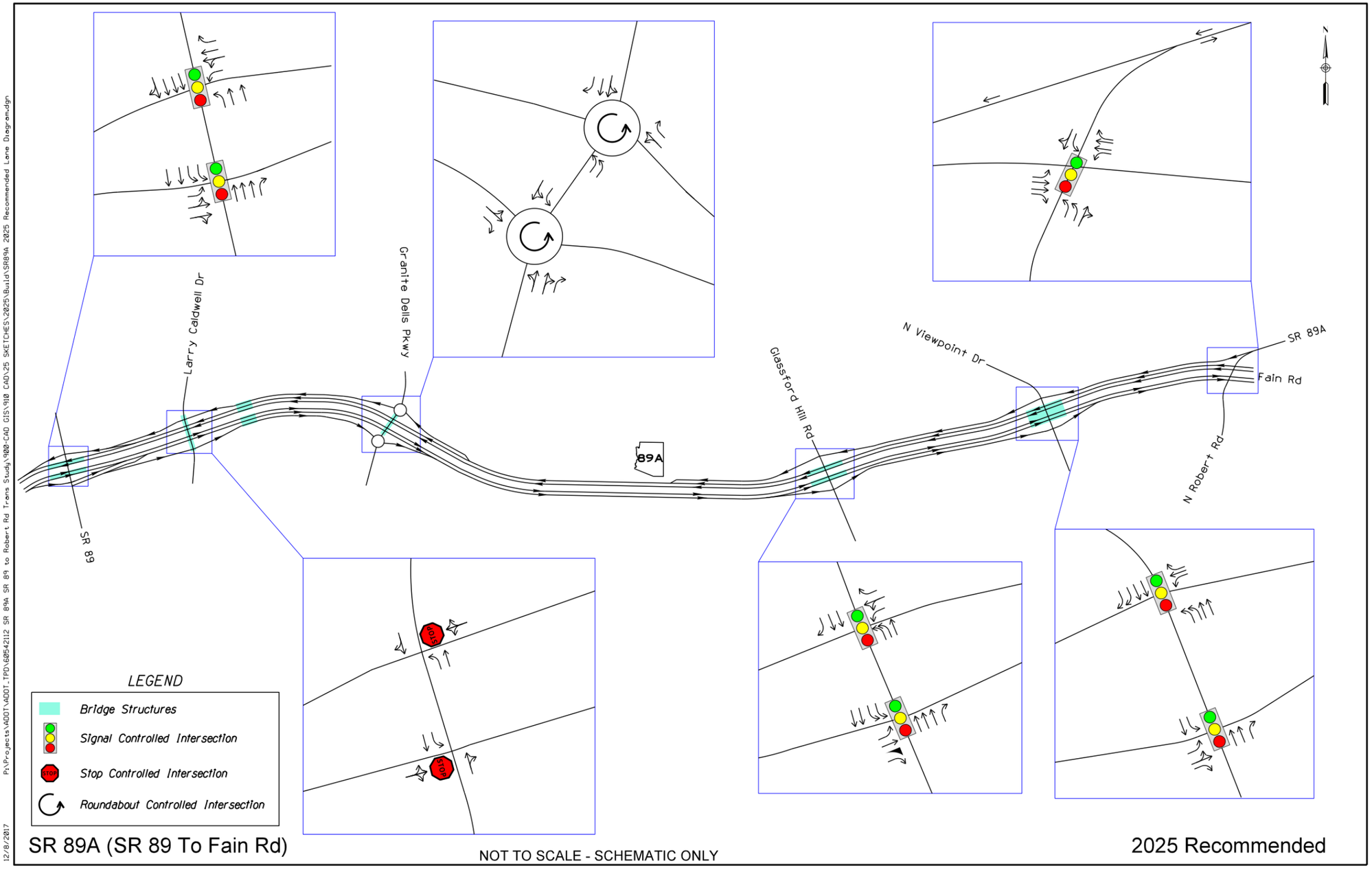


Figure 27: 2030 Build Recommended Roadway Features

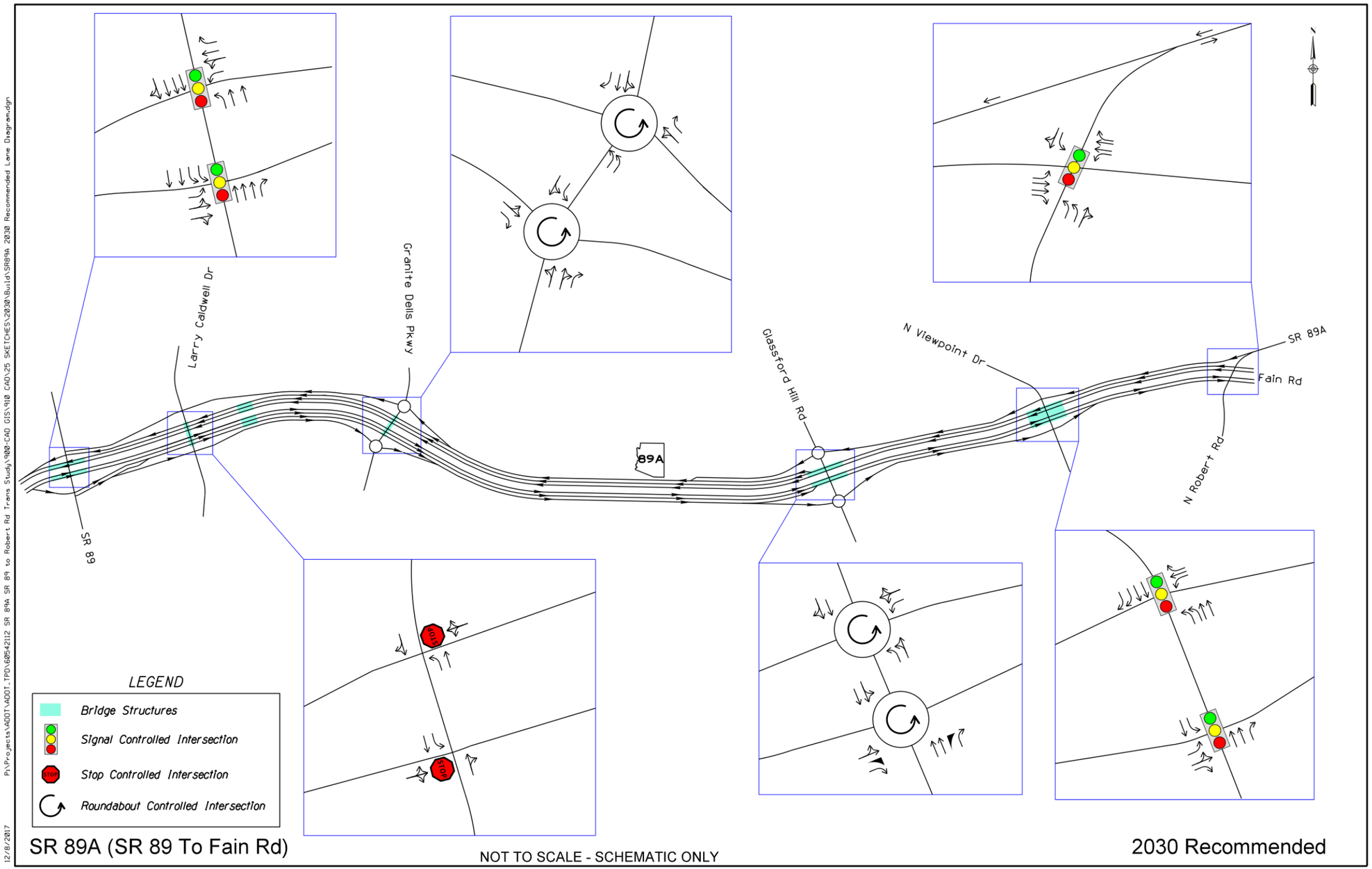


Figure 28: 2035 Build Recommended Roadway Features

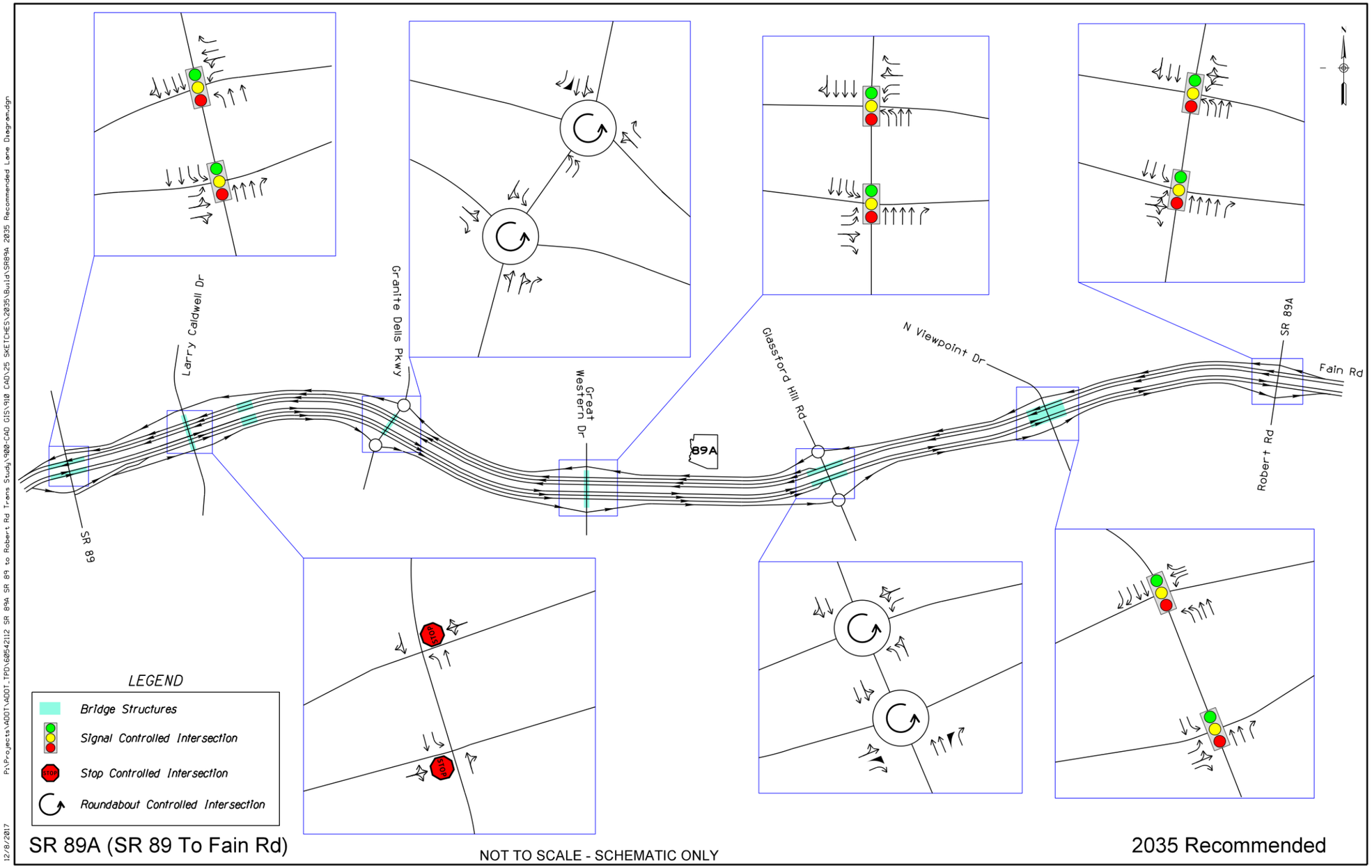


Table 7: AM Peak Hour Build Comparison Intersection LOS Results

Intersection Location	Intersection Approach	2017 AM Existing		2025 AM Build		2030 AM Build		2035 AM Build		2040 AM Build	
		Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay
SR 89A and SR 89 TI	EB SR 89A Off Ramp	D (39)	C (31.7)	D (36)	C (29.8)	D (41)	D (35.4)	D (45)	D (43.8)	D (54)	**E (65.0)**
	WB SR 89A Off Ramp	C (32)		C (26)		C (30)		D (37)		**E (76)**	
	NB SR 89	C (25)		C (29)		C (34)		D (36)		D (44)	
	SB SR 89	C (33)		C (32)		D (40)		**E (55)**		**E (67)**	
SR 89A and Larry Caldwell Dr. TI	EB SR 89A Frontage Road	B (14)	A (8)	B (14)	A (8.3)	B (18)	A (9.5)	C (22)	B (11.3)	C (33)	B (16.8)
	WB SR 89A Off Ramp	A (9)		B (12)		B (13)		B (15)		C (23)	
	NB Larry Caldwell Dr	A (1)		A (1)		A (2)		A (3)		A (2)	
	SB Larry Caldwell Dr	A (0)		A (1)		A (1)		A (1)		A (1)	
SR 89A and Granite Dells Pkwy TI	EB SR 89A Off Ramp	A (0)	A (0.6)	A (7)	A (4.9)	A (7)	A (6.1)	A (5)	A (5.5)	A (7)	A (5.9)
	WB SR 89A Off Ramp	A (1)		A (5)		A (7)		A (6)		A (9)	
	NB Granite Dells Pkwy	A (0)		A (3)		A (3)		A (3)		A (4)	
	SB Granite Dells Pkwy	A (1)		A (5)		A (7)		A (7)		A (4)	
SR 89A and Great Western TI	EB SR 89A Off Ramp	N/A	N/A	N/A	N/A	N/A	N/A	B (14)	C (24.1)	B (15)	C (27.2)
	WB SR 89A Off Ramp	N/A		N/A		N/A		C (27)		C (32)	
	NB Great Western Dr	N/A		N/A		N/A		C (33)		D (35)	
	SB Great Western Dr	N/A		N/A		N/A		B (18)		C (22)	
SR 89A and Glassford Hill Rd. TI	EB SR 89A Off Ramp	B (17)	C (27)	A (1)	C (20.7)	A (1)	A (7.5)	A (1)	A (4.2)	A (2)	A (7.1)
	WB SR 89A Off Ramp	D (45)		C (33)		B (13)		A (7)		B (12)	
	NB Glassford Hill Rd	C (24)		C (25)		A (7)		A (4)		A (6)	
	SB Glassford Hill Rd	N/A		N/A		C (20)		A (7)		B (16)	
SR 89A and Viewpoint Dr. TI	EB SR 89A Off Ramp	B (12)	B (13)	B (15)	B (16.0)	B (17)	B (18.1)	C (20)	C (22.1)	B (19)	C (24.4)
	WB SR 89A Off Ramp	C (24)		B (17)		B (19)		C (21)		C (22)	
	NB Viewpoint Dr	B (20)		C (28)		C (28)		C (32)		C (32)	
	SB Viewpoint Dr	A (8)		B (11)		B (14)		B (19)		C (25)	
SR 89A and Robert Road	EB SR 89A	C (22)	C (23.5)	(C) 26	(C) 31.1	C (29)	C (33.6)	B (15)	C (26.9)	B (14)	C (28.1)
	WB Fain Rd	C (27)		(C) 34		D (36)		C (22)		C (22)	
	NB Robert Rd	C (26)		(D) 42		D (45)		D (42)		D (45)	
	SB SR 89A	B (18)		(C) 21		C (23)		B (19)		C (20)	

Table 8: PM Peak Hour Build Comparison Intersection LOS Results

Intersection Location	Intersection Approach	2017 PM Existing		2025 PM Build		2030 PM Build		2035 PM Build		2040 PM Build	
		Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay	Intersection Approach LOS & Delay	Overall Intersection LOS & Delay
SR 89A and SR 89 TI	EB SR 89A Off Ramp	D (42)	C (25.4)	D (48)	C (32.6)	**F (81)**	D (55.0)	**E (61)**	D (52.7)	**E (58)**	**E (56.4)**
	WB SR 89A Off Ramp	C (27)		C (21)		C (29)		C (30)		C (27)	
	NB SR 89	C (22)		D (44)		**F (84)**		**F (85)**		**F (98)**	
	SB SR 89	C (25)		C (31)		D (47)		D (40)		D (54)	
SR 89A and Larry Caldwell Dr. TI	EB SR 89A Frontage Road	A (9)	A (2.5)	B (11)	A (3.9)	B (13)	A (4.8)	B (14)	A (5.5)	B (15)	A (5.8)
	WB SR 89A Off Ramp	A (7)		A (8)		A (8)		A (9)		A (10)	
	NB Larry Caldwell Dr	A (1)		A (2)		A (2)		A (2)		A (3)	
	SB Larry Caldwell Dr	A (1)		A (1)		A (1)		A (1)		A (2)	
SR 89A and Granite Dells Pkwy TI	EB SR 89A Off Ramp	A (0)	A (0.4)	A (5)	A (4.2)	A (7)	A (5.6)	A (9)	A (4.5)	B (12)	A (5.4)
	WB SR 89A Off Ramp	A (1)		A (4)		A (5)		A (2)		A (3)	
	NB Granite Dells Pkwy	A (0)		A (3)		A (4)		A (3)		A (4)	
	SB Granite Dells Pkwy	A (0)		A (5)		A (7)		A (5)		A (3)	
SR 89A and Great Western TI	EB SR 89A Off Ramp	N/A	N/A	N/A	N/A	N/A	N/A	B (13)	B (18.0)	A (9)	B (16.4)
	WB SR 89A Off Ramp	N/A		N/A		N/A		C (22)		B (16)	
	NB Great Western Dr	N/A		N/A		N/A		C (21)		B (20)	
	SB Great Western Dr	N/A		N/A		N/A		B (19)		C (21)	
SR 89A and Glassford Hill Rd. TI	EB SR 89A Off Ramp	C (22)	C (25.4)	A (1)	B (12.4)	D (36)	B (15.5)	A (1)	A (2.6)	B (19)	A (9.4)
	WB SR 89A Off Ramp	D (53)		C (25)		A (6)		A (5)		A (6)	
	NB Glassford Hill Rd	B (20)		B (17)		A (3)		A (3)		A (3)	
	SB Glassford Hill Rd	N/A		N/A		A (6)		A (5)		A (6)	
SR 89A and Viewpoint Dr. TI	EB SR 89A Off Ramp	B (15)	B (17.1)	C (24)	C (22.4)	C (32)	C (27.7)	**E (60)**	D (45.7)	D (51)	D (39.9)
	WB SR 89A Off Ramp	C (32)		B (18)		C (21)		C (28)		C (26)	
	NB Viewpoint Dr	C (22)		C (28)		C (33)		D (47)		D (42)	
	SB Viewpoint Dr	B (12)		B (14)		B (16)		C (22)		B (20)	
SR 89A and Robert Road	EB SR 89A	C (21)	C (23.1)	C (24)	C (28.6)	C (30)	C (34.1)	B (17)	B (18.9)	C (20)	C (22.4)
	WB Fain Rd	C (27)		C (35)		D (39)		B (16)		B (18)	
	NB Robert Rd	C (29)		D (42)		D (49)		C (24)		C (28)	
	SB SR 89A	B (18)		B (19)		C (22)		B (17)		B (20)	

Table 9: AM & PM Peak Hour Build Comparison SR 89A Mainline LOS Results

Segment Description	AM Peak Hour										PM Peak Hour									
	2017 Existing		2025 Build		2030 Build		2035 Build		2040 Build		2017 Existing		2025 Build		2030 Build		2035 Build		2040 Build	
	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS
Eastbound/Northbound SR 89A																				
Project Limit to SR 89 EB Exit Ramp	8	A	9	A	12	B	13	B	16	B	12	B	18	C	23	C	26	C	30	D
SR 89 EB Exit Ramp to SR 89 EB Entr Ramp	5	A	5	A	7	A	7	A	9	A	9	A	13	B	17	B	18	C	21	C
SR 89 EB Entrance Ramp to Larry Caldwell EB Entr Ramp	9	A	11	B	9	A	9	A	10	A	14	B	19	C	15	B	16	B	18	C
Larry Caldwell EB Entr Ramp to Granite Dells EB Exit Ramp	6	A	8	A	7	A	8	A	9	A	11	B	14	B	12	B	14	B	16	B
Granite Dells EB Exit Ramp to Granite Dells EB Entr Ramp	8	A	9	A	6	A	7	A	8	A	16	B	18	B	13	B	15	B	16	B
Granite Dells EB Entr Ramp to Glassford Hill EB Exit Ramp (or Great Western EB Exit Ramp)	9	A	13	B	10	A	9	A	10	A	16	B	22	C	17	B	17	B	20	C
Great Western EB Exit Ramp to Great Western EB Entr Ramp	n/a	n/a	n/a	n/a	n/a	n/a	8	A	9	A	n/a	n/a	n/a	n/a	n/a	n/a	15	B	17	B
Great Western EB Entr Ramp to Glassford Hill EB Exit Ramp	n/a	n/a	n/a	n/a	n/a	n/a	8	A	9	A	n/a	n/a	n/a	n/a	n/a	n/a	23	C	20	C
Glassford Hill EB Exit Ramp to Glassford Hill EB Entr Ramp	4	A	7	A	8	A	10	A	7	A	9	A	13	B	15	B	18	B	14	B
Glassford Hill EB Entr Ramp to Viewpoint Dr EB Exit Ramp	4	A	7	A	9	A	9	A	7	A	9	A	14	B	20	C	23	C	35	D
Viewpoint Dr EB Exit Ramp to Viewpoint Dr EB Entr Ramp	4	A	5	A	7	A	7	A	5	A	6	A	9	A	11	B	12	B	11	A
Viewpoint Dr EB Entr Ramp to Robert Road Intersection (or Robert Road EB Exit Ramp)	4	A	7	A	8	A	6	A	5	A	7	A	10	A	13	B	9	A	8	A
Robert Road EB Exit Ramp to Robert Road EB Entr Ramp	n/a	n/a	n/a	n/a	n/a	n/a	6	A	4	A	n/a	n/a	n/a	n/a	n/a	n/a	8	A	7	A
Robert Road EB Entr Ramp to Project Limit	n/a	n/a	n/a	n/a	n/a	n/a	7	A	6	A	n/a	n/a	n/a	n/a	n/a	n/a	11	A	9	A
Westbound/Southbound SR 89A																				
Project Limit to Robert Road WB Exit Ramp	n/a	n/a	n/a	n/a	n/a	n/a	12	B	9	A	n/a	n/a	n/a	n/a	n/a	n/a	7	A	6	A
Robert Road WB Exit Ramp to Robert Road WB Entr Ramp	n/a	n/a	n/a	n/a	n/a	n/a	10	A	8	A	n/a	n/a	n/a	n/a	n/a	n/a	6	A	5	A
Robert Road Intersection (or Robert Road WB Entr Ramp) to Viewpoint Dr WB Exit Ramp	6	A	9	A	11	A	12	B	10	A	4	A	5	A	6	A	7	A	6	A
Viewpoint Dr WB Exit Ramp to Viewpoint Dr WB Entr Ramp	8	A	12	B	14	B	16	B	12	B	5	A	6	A	8	A	8	A	7	A
Viewpoint Dr WB Entr Ramp to Glassford Hill WB Exit Ramp	11	A	17	B	21	C	25	C	20	C	5	A	8	A	9	A	10	A	9	A
Glassford Hill WB Exit Ramp to Glassford Hill WB Entr Ramp	12	B	17	B	19	C	26	D	18	C	5	A	7	A	9	A	10	A	8	A
Glassford Hill WB Entr Ramp to Granite Dells WB Exit Ramp (or Great Western WB Exit Ramp)	19	C	27	D	21	C	17	B	20	C	10	A	14	B	11	A	9	A	10	A
Great Western WB Exit Ramp to Great Western WB Entr Ramp	n/a	n/a	n/a	n/a	n/a	n/a	19	C	22	C	n/a	n/a	n/a	n/a	n/a	n/a	9	A	10	A
Great Western WB Entr Ramp to Granite Dells WB Exit Ramp	n/a	n/a	n/a	n/a	n/a	n/a	18	B	20	C	n/a	n/a	n/a	n/a	n/a	n/a	9	A	11	A
Granite Dells WB Exit Ramp to Granite Dells WB Entr Ramp	18	C	22	C	16	B	20	C	20	C	10	A	11	A	7	A	9	A	10	A
Granite Dells WB Entr Ramp to Larry Caldwell WB Exit Ramp	13	B	18	C	16	B	19	C	23	C	7	A	10	A	9	A	1510	A	11	B
Larry Caldwell WB Exit Ramp to SR 89 WB Exit Ramp	21	C	24	C	18	C	21	C	23	C	10	A	14	B	10	A	12	B	12	B
SR 89 WB Exit Ramp to SR 89 WB Entr Ramp	11	A	15	B	12	B	14	B	16	B	5	A	6	A	5	A	6	A	6	A
SR 89 WB Entr Ramp to Project Limit	15	B	24	C	18	B	20	C	23	C	8	A	11	B	8	A	9	A	10	A

Appendix 1 - No-Build Volume and Configurations

LEGEND

XXX - 2025 AM Peak Hour Volumes
(XXX) - 2025 PM Peak Hour Volumes
XXXX - 2025 Average Daily Traffic

N

1830
(770)
12200

1110
(980)
12000

230
(410)
4500

2960
(1750)
24200

290
(90)
2100

3250
(1840)
26300

400
(460)
4200

2850
(1380)
22100

510
(410)
4600

250
(250)
3100

280
(250)
3100

600
(1440)
12300

910
(1000)
12000

290
(210)
3200

1510
(2440)
24300

130
(290)
2200

1640
(2730)
26500

380
(420)
3800

1260
(2310)
22700

430
(460)
4600

3360
(1790)
26700

1690
(2770)
27300

89A

SR 89

Larry Caldwell Dr

Granite Dells Pkwy

MATCH LINE
See Sheet 2 of 2

SR 89A 2025 NO-BUILD VOLUMES AND LANE CONFIGURATION SHEET 1 OF 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

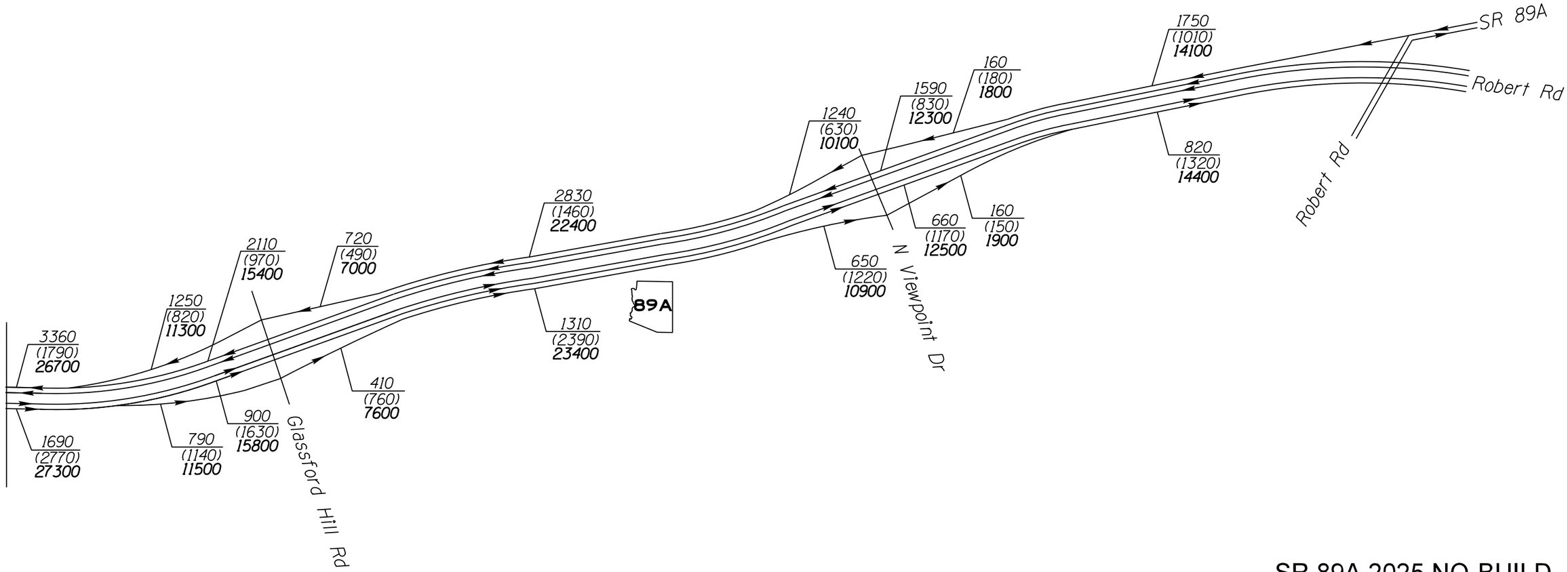
11/7/2017

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\No Build\SR89A Ramp Volumes 1_NB2025.dgn

LEGEND

XXX - 2025 AM Peak Hour Volumes
(XXX) - 2025 PM Peak Hour Volumes
XXXX - 2025 Average Daily Traffic

N



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2025 NO-BUILD VOLUMES AND LANE CONFIGURATION SHEET 2 OF 2

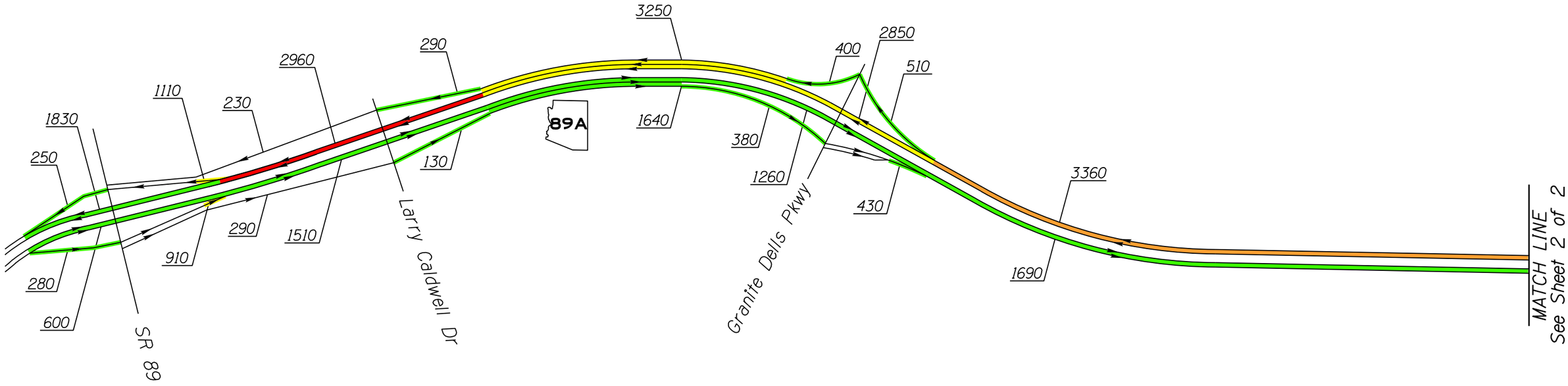
11/7/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\No Build\SR89A Ramp Volumes 2_NB2025.dgn

LEGEND

XXX - 2025 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2025 NO-BUILD
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\No Build\SR89A 2025 NB LOS AM.dgn

11/7/2017

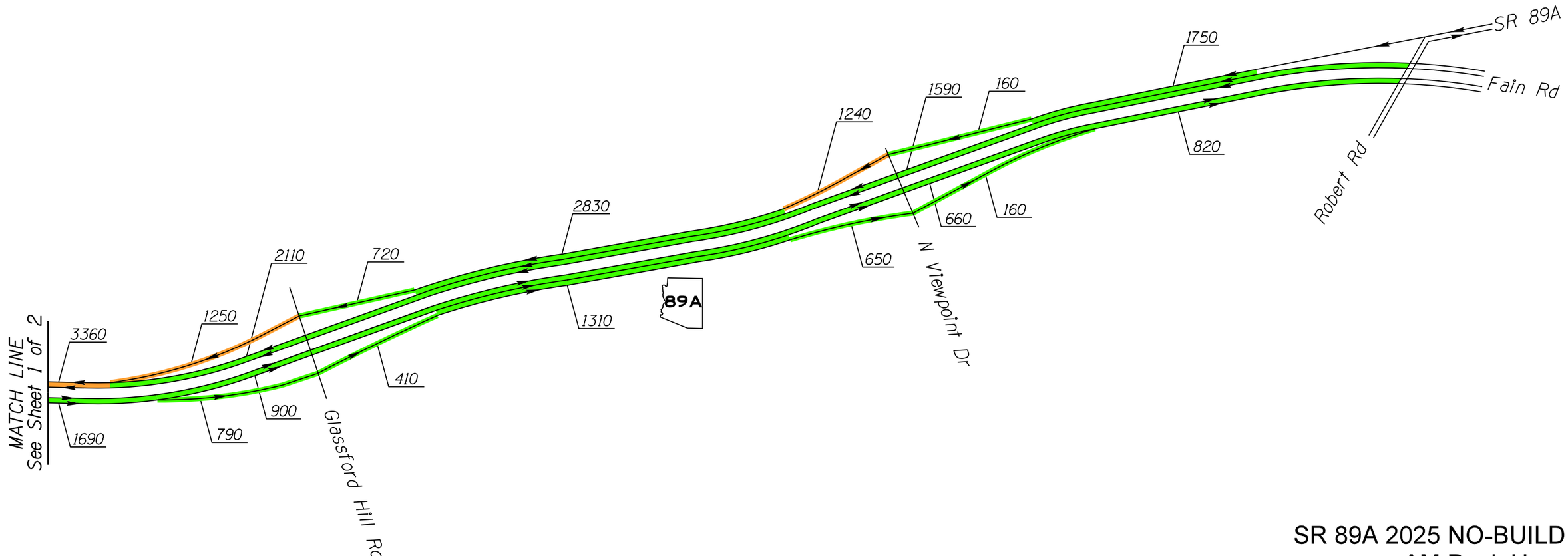
LEGEND

XXX - 2025 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2025 NO-BUILD
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

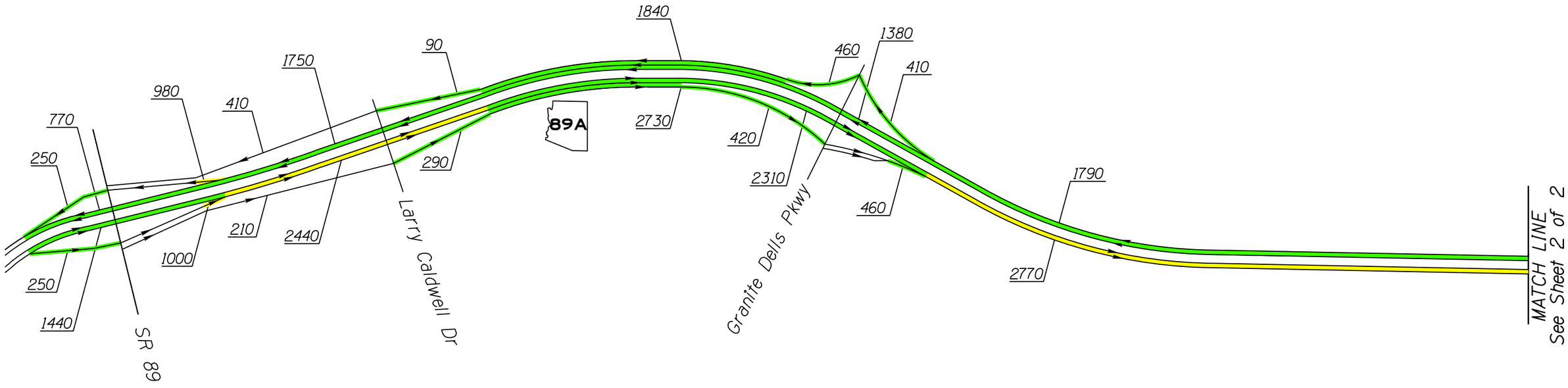
11/7/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\No Build\SR89A 2025 NB LOS AM 2.dgn

LEGEND

XXX - 2025 PM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A 2025 NO-BUILD
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\No Build\SR89A 2025 NB LOS PM.dgn

11/7/2017

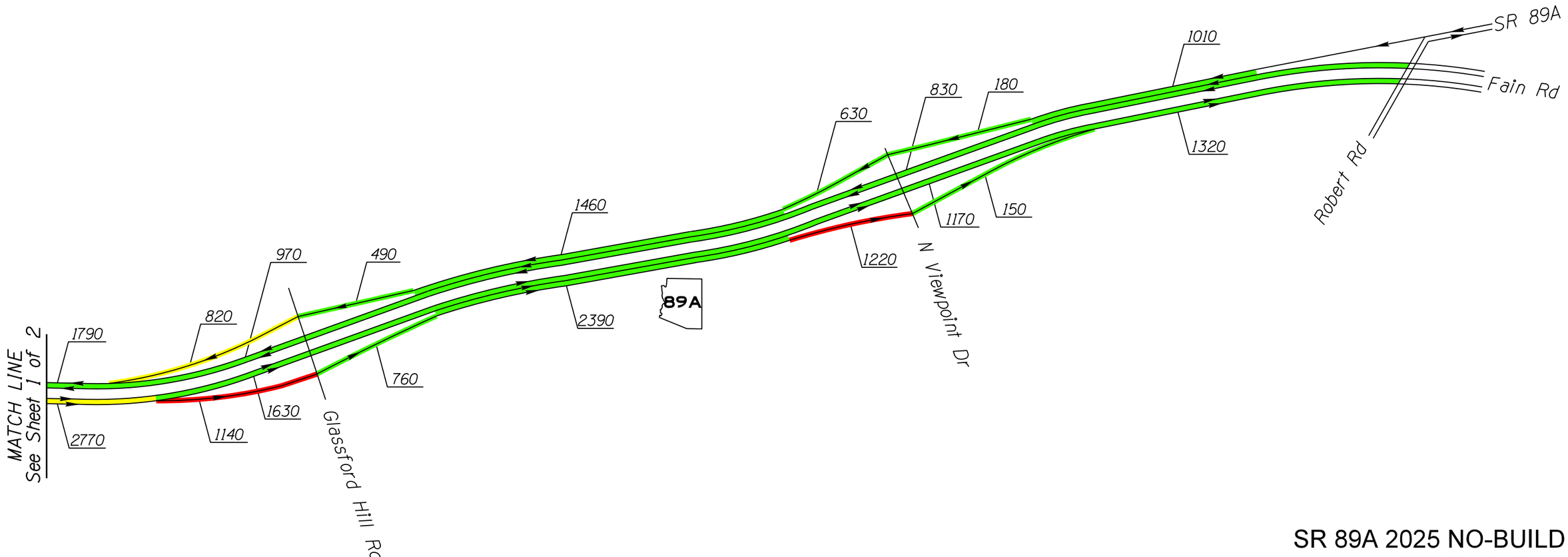
LEGEND

XXX - 2025 PM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N



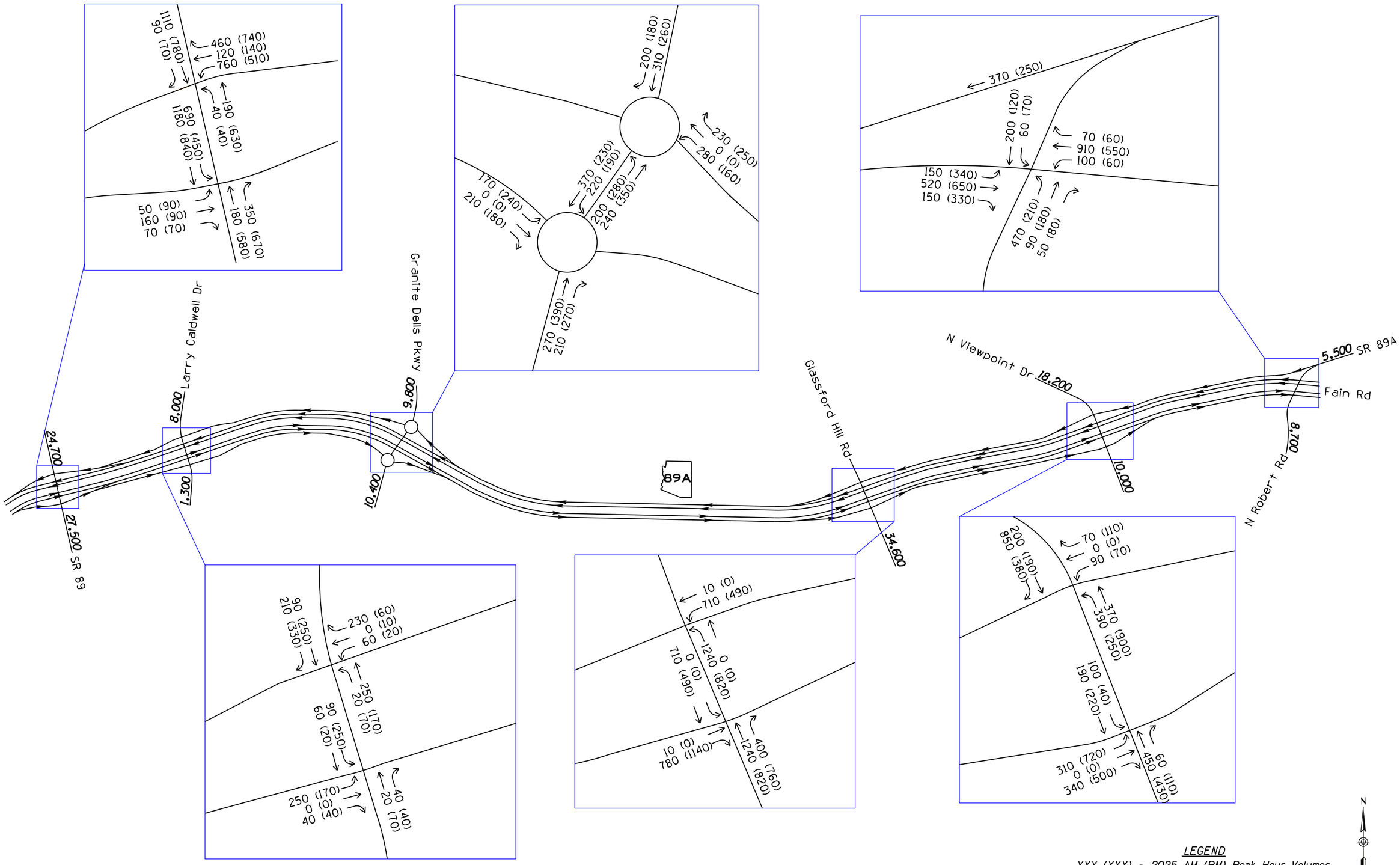
SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2025 NO-BUILD
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\No Build\SR89A 2025 NB LOS PM 2.dgn

11/7/2017



LEGEND

XXX (XXX) - 2025 AM (PM) Peak Hour Volumes

XXXX - 2025 Average Daily Traffic

SR 89A (SR 89 To Fain Rd)

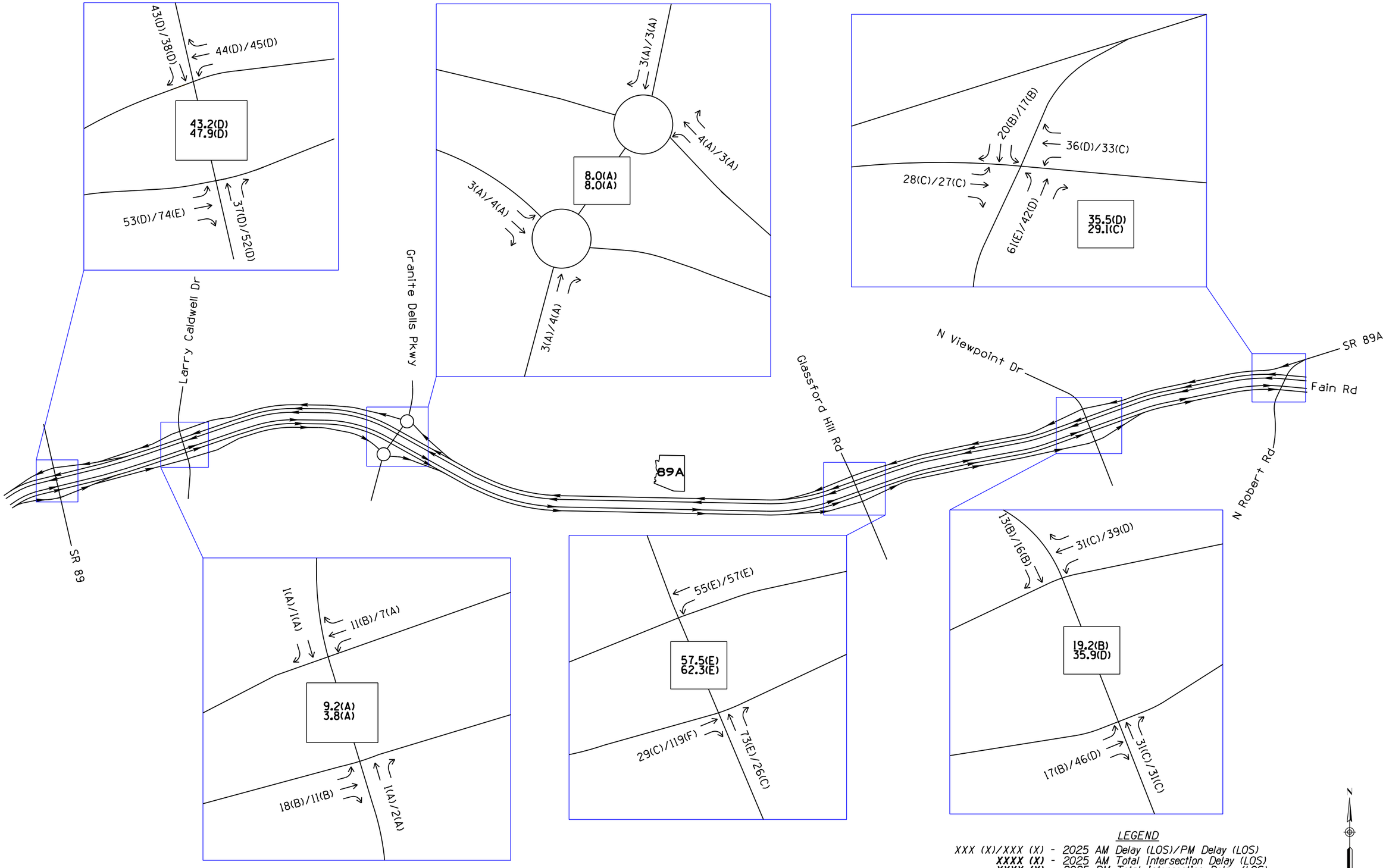
NOT TO SCALE - SCHEMATIC ONLY

11/7/2017

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\No Build\SR89A 2025 NB Volume Diagram.dgn

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\No Build\SR89A 2025 NB Int LOS Diagram.dgn

11/7/2017



LEGEND

XXX (X)/XXX (X) - 2025 AM Delay (LOS)/PM Delay (LOS)
XXXX (X) - 2025 AM Total Intersection Delay (LOS)
XXXX (X) - 2025 PM Total Intersection Delay (LOS)

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

LEGEND

XXX - 2030 AM Peak Hour Volumes
(XXX) - 2030 PM Peak Hour Volumes
XXXX - 2030 Average Daily Traffic

N

2340
(900)
14600

1200
(1070)
13800

300
(420)
4500

3540
(1970)
28400

320
(120)
2300

3860
(2090)
30700

760
(690)
6300

3100
(1400)
24400

900
(730)
7000

290
(290)
3600

300
(270)
3600

780
(1840)
14800

SR 89

980
(1090)
13700

340
(280)
3800

1760
(2930)
28500

150
(310)
2500

Larry Caldwell Dr

89A

1910
(3240)
31000

690
(730)
6400

1220
(2510)
24600

Granite Dells Pkwy

780
(780)
7800

4000
(2130)
31400

2000
(3290)
32400

MATCH LINE
See Sheet 2 of 2

SR 89A 2030 NO-BUILD
VOLUMES AND LANE CONFIGURATION
SHEET 1 OF 2

SR 89A (SR 89 To Fain Rd)

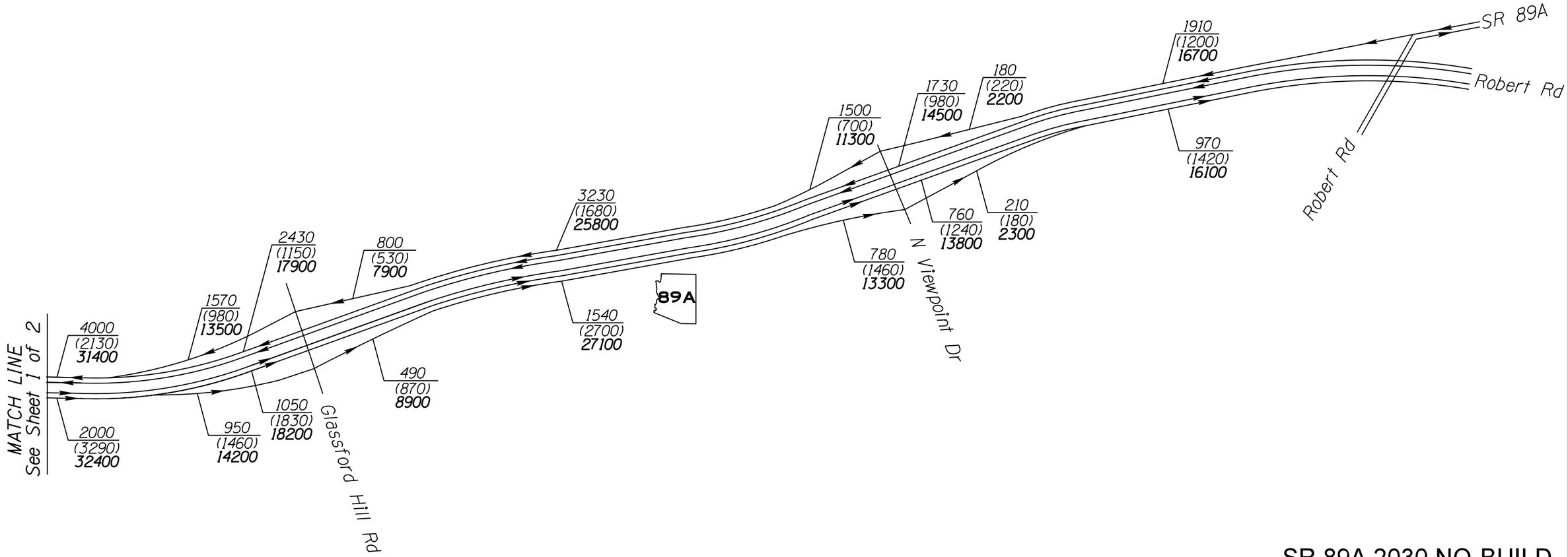
NOT TO SCALE - SCHEMATIC ONLY

11/7/2017

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\No Build\SR89A Ramp Volumes 1_NB2030.dgn

LEGEND

XXX - 2030 AM Peak Hour Volumes
(XXX) - 2030 PM Peak Hour Volumes
XXXX - 2030 Average Daily Traffic



SR 89A 2030 NO-BUILD
VOLUMES AND LANE CONFIGURATION
SHEET 2 OF 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

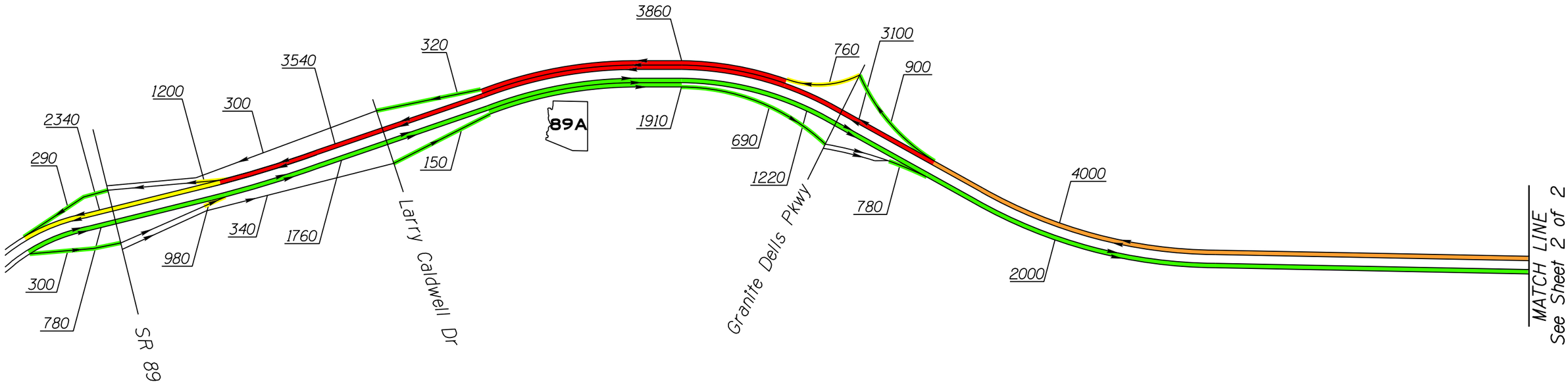
11/7/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\No Build\SR89A Ramp Volumes 2_NB2030.dgn

LEGEND

XXX - 2030 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2030 NO-BUILD
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

11/7/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\No Build\SR89A 2030 NB LOS AM.dgn

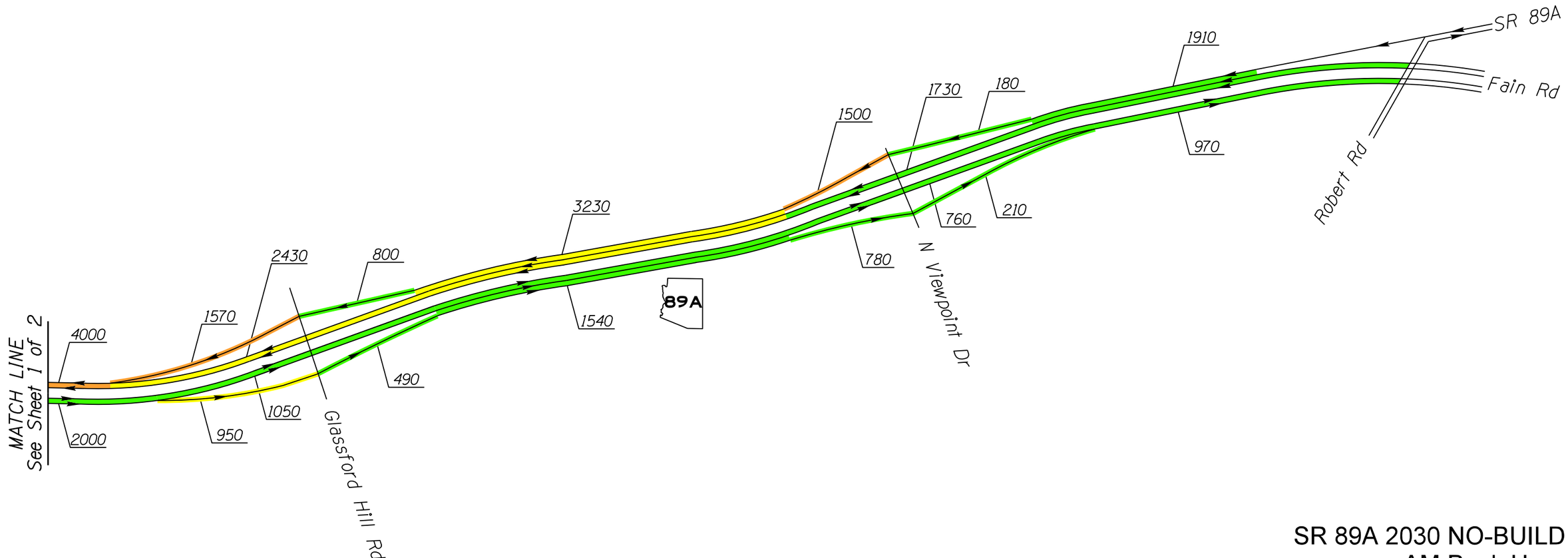
LEGEND

XXX - 2030 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2030 NO-BUILD
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

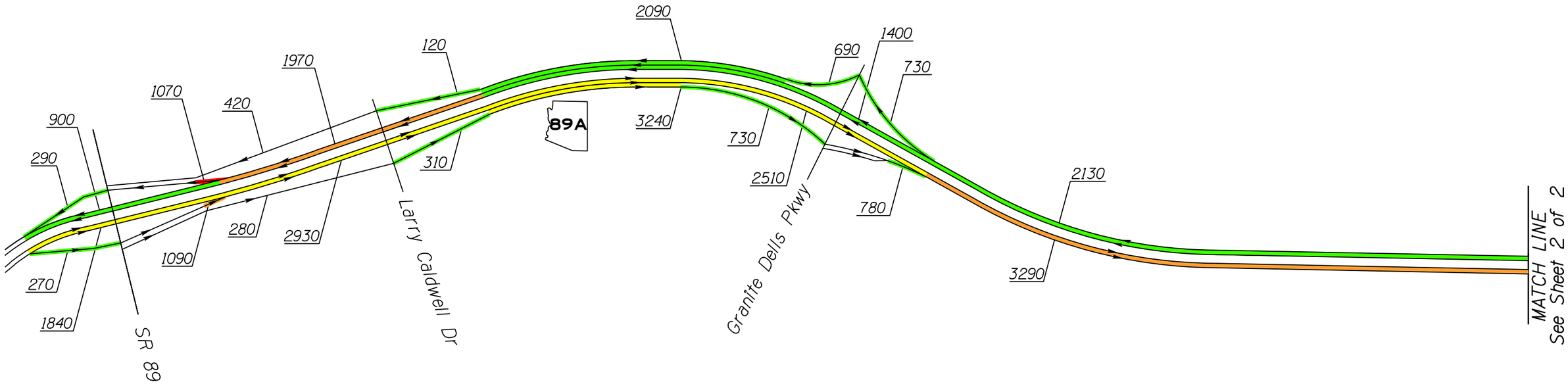
11/7/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\No Build\SR89A 2030 NB LOS AM 2.dgn

LEGEND

XXX - 2030 PM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2030 NO-BUILD
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\No Build\SR89A 2030 NB LOS PM.dgn

11/7/2017

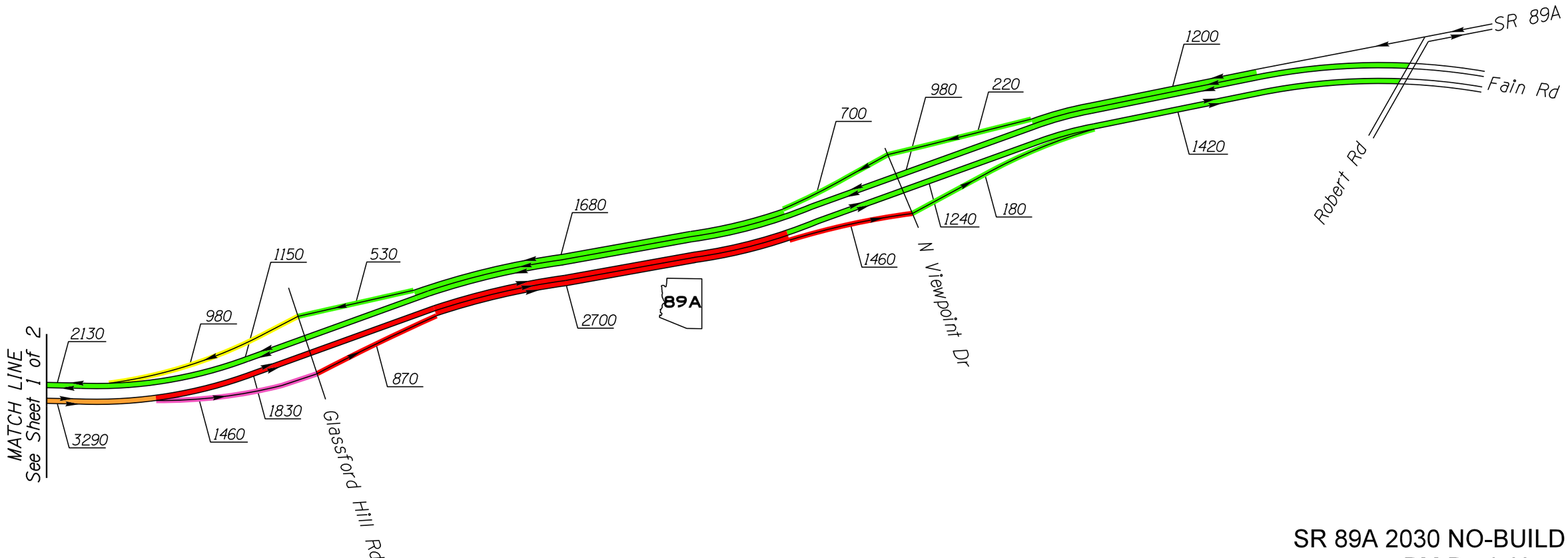
LEGEND

XXX - 2030 PM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N



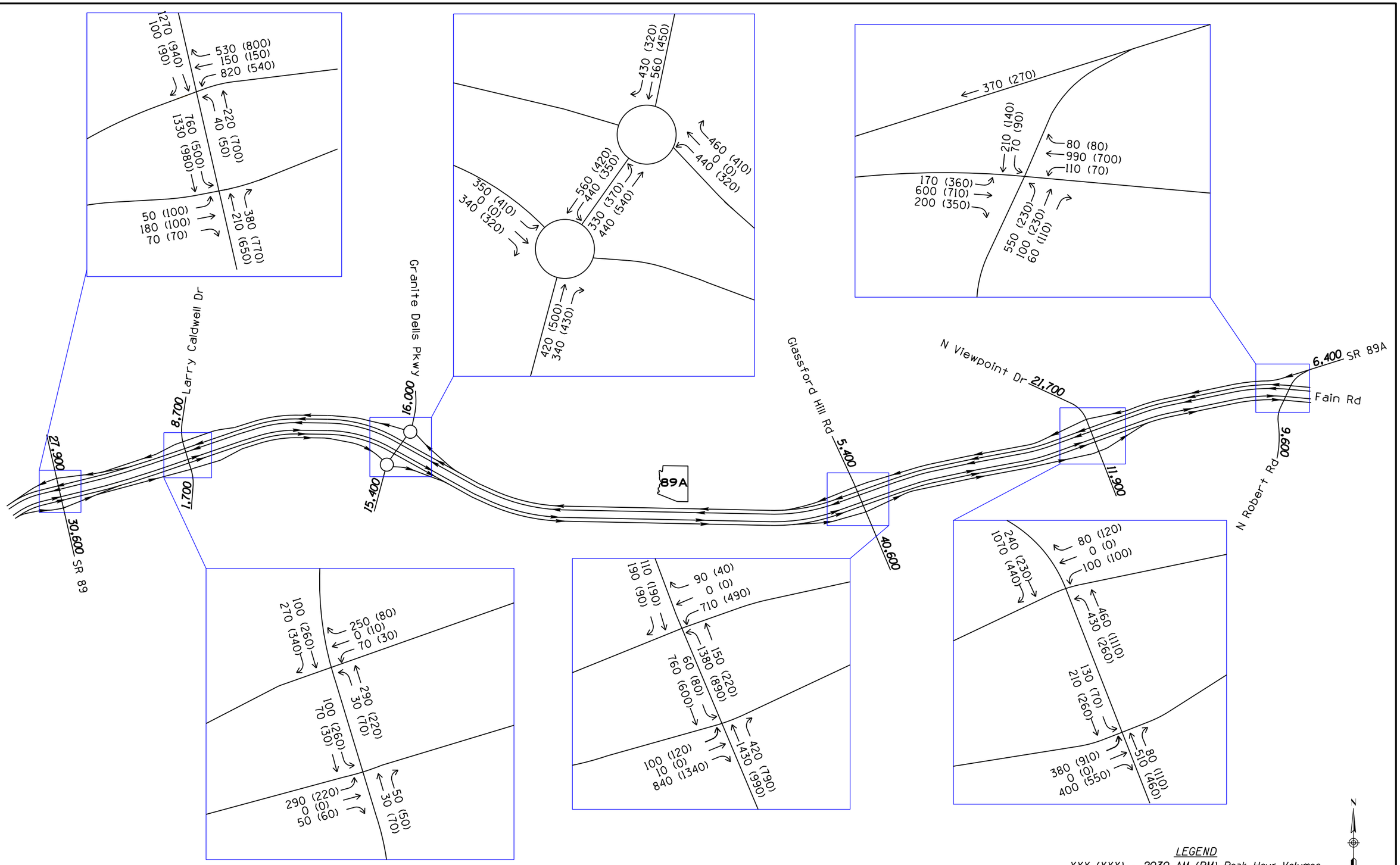
SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2030 NO-BUILD
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\No Build\SR89A 2030 NB LOS PM 2.dgn

11/7/2017



LEGEND

XXX (XXX) - 2030 AM (PM) Peak Hour Volumes

XXXX - 2030 Average Daily Traffic

N

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

11/7/2017

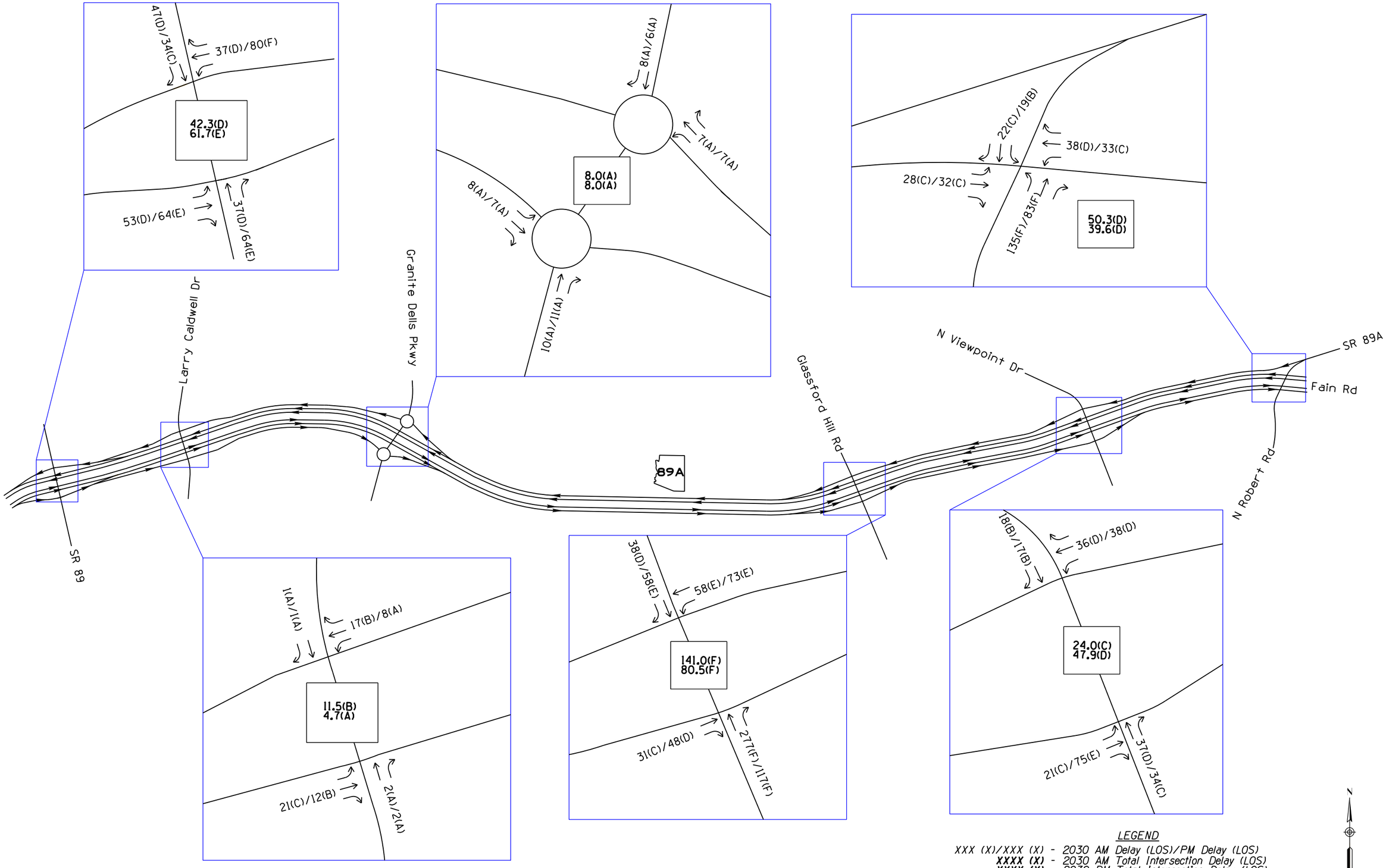
P:\Projects\ADOT\ADOT_IPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\No Build\SR89A 2030 NB Volume Diagram.dgn

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\No Build\SR89A 2030 NB LOS Diagram.dgn

11/7/2017

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY



LEGEND

XXX (X)/XXX (X) - 2030 AM Delay (LOS)/PM Delay (LOS)
***XXXX (X)** - 2030 AM Total Intersection Delay (LOS)*
***XXXX (X)** - 2030 PM Total Intersection Delay (LOS)*

LEGEND

XXX - 2035 AM Peak Hour Volumes
(XXX) - 2035 PM Peak Hour Volumes
XXXX - 2035 Average Daily Traffic

N

2670
(1080)
16900

320
(320)
4000

340
(310)
4000

840
(2030)
17300

SR 89

1300
(1170)
15400

360
(430)
4500

1070
(1180)
15300

3970
(2250)
32300

410
(320)
4300

1910
(3210)
32600

370
(160)
2400

200
(350)
2900

Larry Caldwell Dr

89A

4340
(2410)
34700

2110
(3560)
35500

1010
(950)
8400

820
(1000)
8600

1290
(2560)
26900

3330
(1460)
26300

1000
(1250)
11000

Granite Dells Pkwy

1280
(920)
9900

4610
(2380)
36200

2290
(3810)
37900

MATCH LINE
See Sheet 2 of 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2035 NO-BUILD VOLUMES AND LANE CONFIGURATION SHEET 1 OF 2

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\No Build\SR89A Ramp Volumes 1.NB2035.dgn

11/7/2017

LEGEND

XXX - 2035 AM Peak Hour Volumes
(XXX) - 2035 PM Peak Hour Volumes
XXXX - 2035 Average Daily Traffic

N

MATCH LINE
See Sheet 1 of 2

4610
(2380)
36200

2290
(3810)
37900

1760
(1150)
14700

1080
(1690)
15400

2850
(1230)
21500

1210
(2120)
22500

Glassford Hill Rd

890
(610)
8400

560
(930)
9300

3740
(1840)
29900

1770
(3050)
31800

89A

1660
(800)
12600

2080
(1040)
17300

220
(250)
2700

2300
(1290)
20000

1180
(1710)
20100

870
(1570)
14500

N Viewpoint Dr

900
(1480)
17300

280
(230)
2800

Robert Rd

SR 89A

Robert Rd

SR 89A 2035 NO-BUILD
VOLUMES AND LANE CONFIGURATION
SHEET 2 OF 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

11/7/2017

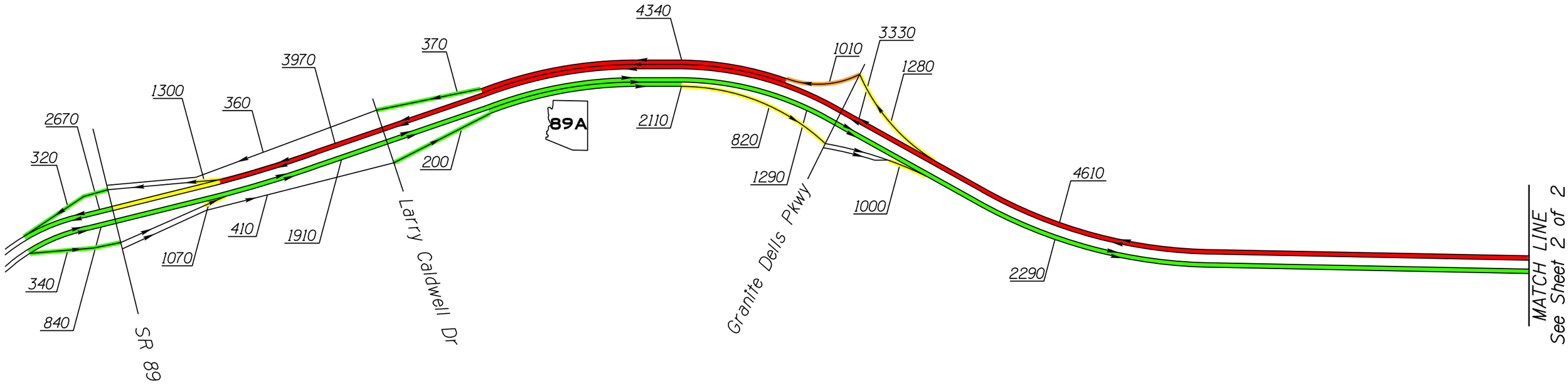
P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\No Build\SR89A Ramp Volumes 2_NB2035.dgn

LEGEND

XXX - 2035 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2035 NO-BUILD
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

11/7/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\No Build\SR89A 2035 NB LOS AM.dgn

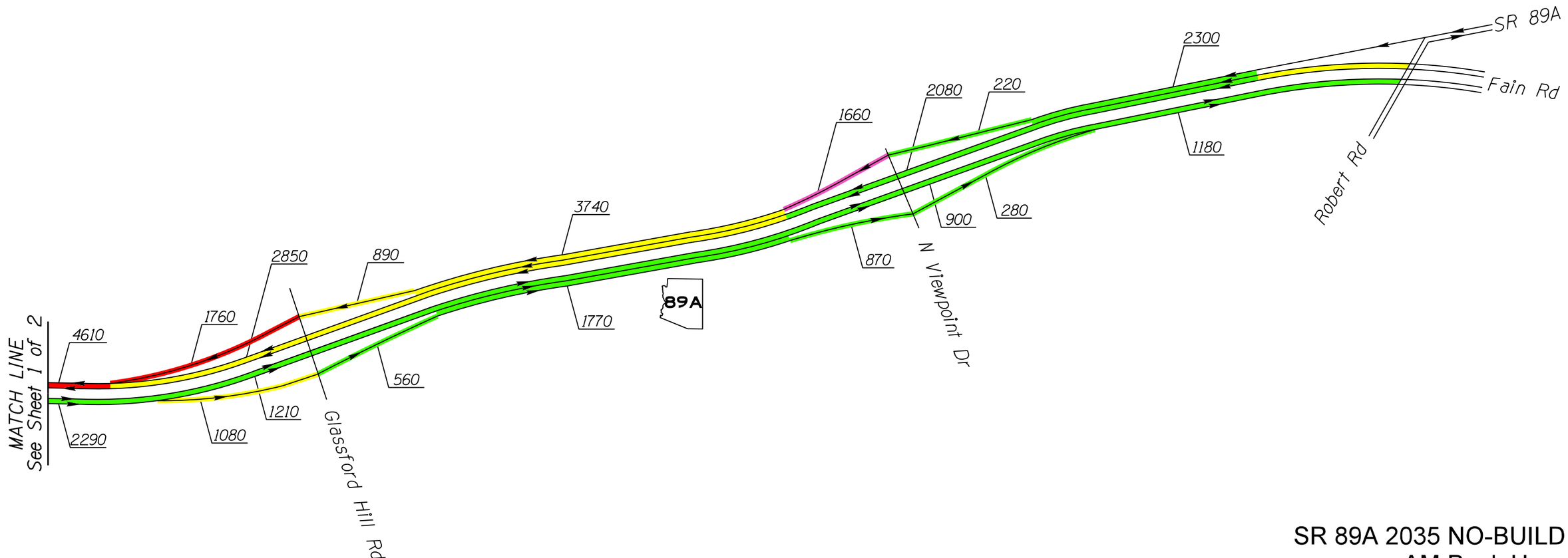
LEGEND

XXX - 2035 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N



SR 89A 2035 NO-BUILD
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

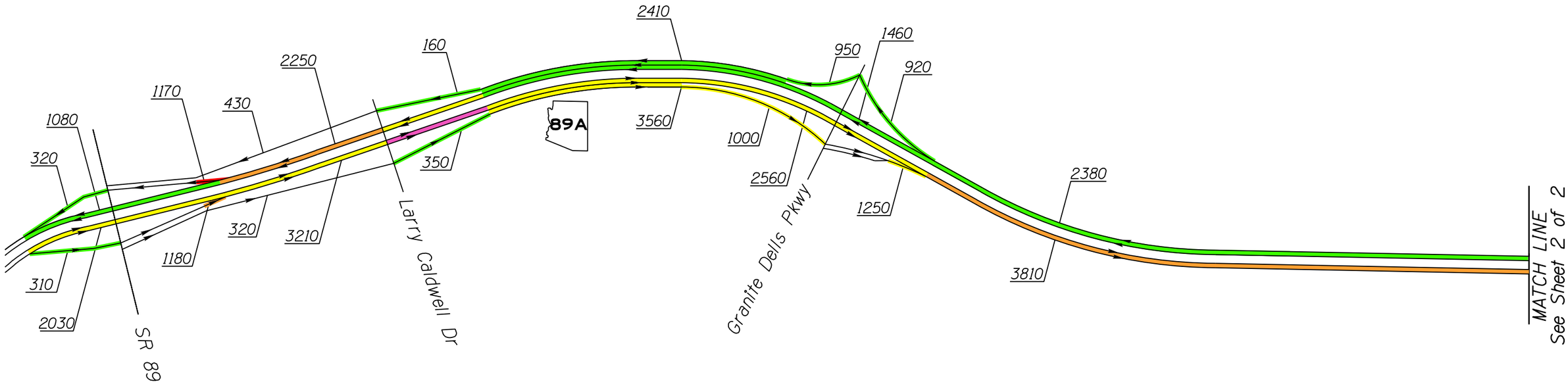
11/7/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\No Build\SR89A 2035 NB LOS AM 2.dgn

LEGEND

XXX - 2035 PM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2035 NO-BUILD
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

11/7/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\No Build\SR89A 2035 NB LOS PM.dgn

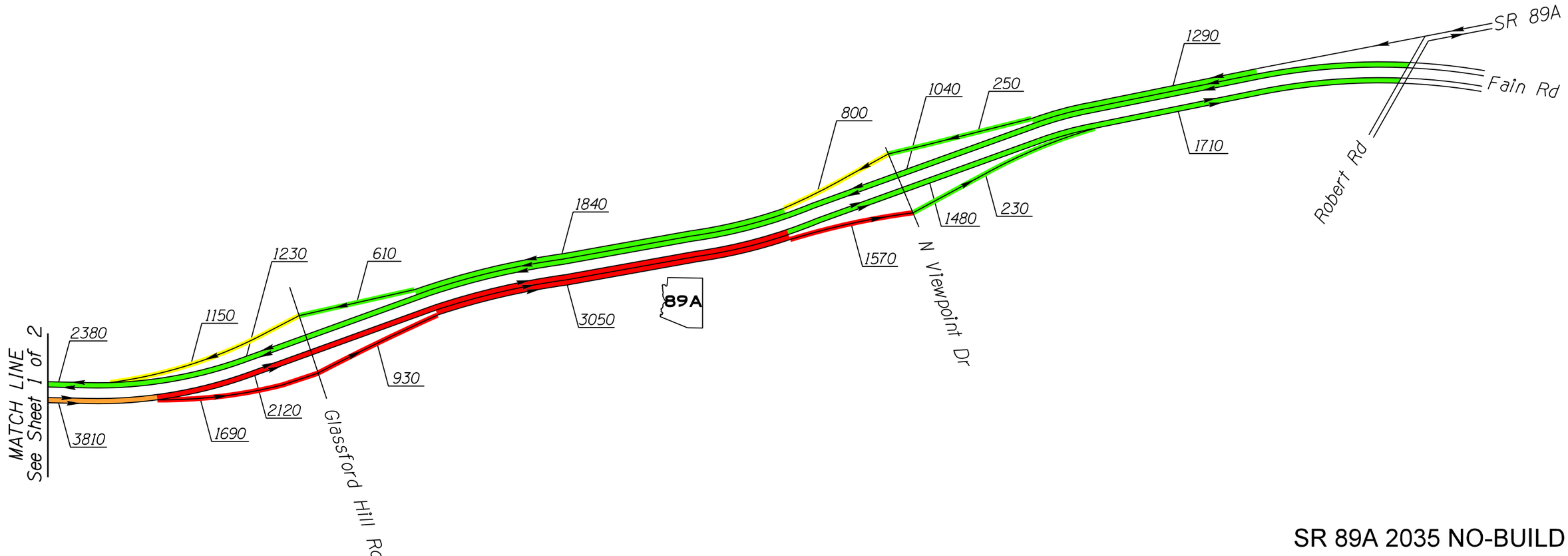
LEGEND

XXX - 2035 PM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N



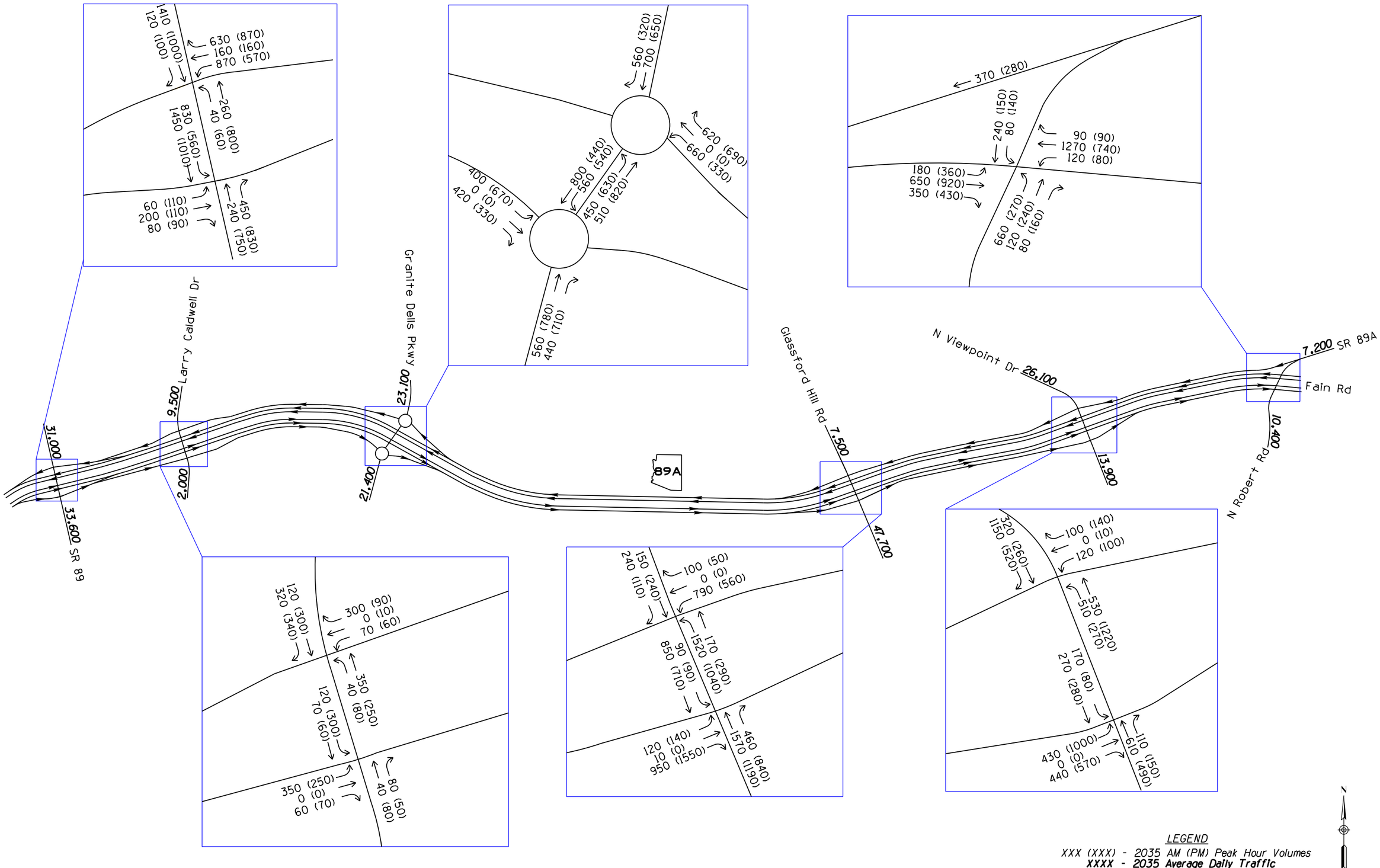
SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2035 NO-BUILD
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\No Build\SR89A 2035 NB LOS PM 2.dgn

11/7/2017



LEGEND

XXX (XXX) - 2035 AM (PM) Peak Hour Volumes

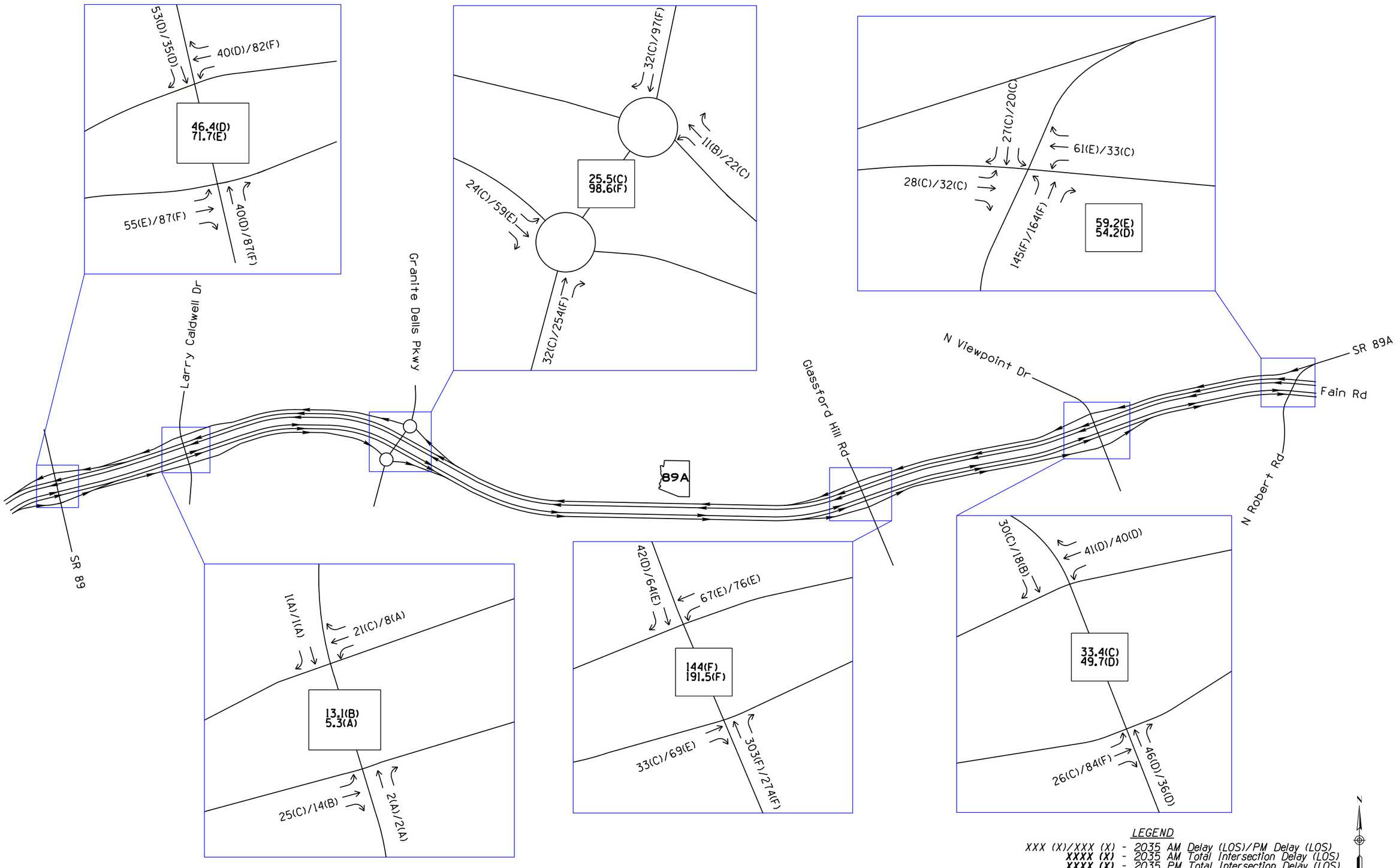
XXXX - 2035 Average Daily Traffic

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

11/7/2017

P:\Projects\ADOT\ADOT_IPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\No Build\SR89A 2035 NB Volume Diagram.dgn



LEGEND

XXX (X)/XXX (X) - 2035 AM Delay (LOS)/PM Delay (LOS)
XXXX (X) *- 2035 AM Total Intersection Delay (LOS)*
XXXX (X) *- 2035 PM Total Intersection Delay (LOS)*

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\No Build\SR89A 2035 NB LOS Diagram.dgn

11/7/2017

LEGEND

XXX - 2040 AM Peak Hour Volumes
(XXX) - 2040 PM Peak Hour Volumes
XXXX - 2040 Average Daily Traffic

N

2970
(1240)
19100

360
(410)
4500

460
(360)
4500

1020
(2270)
19800

1400
(1330)
17500

360
(450)
4500

1210
(1550)
17000

4370
(2570)
36600

490
(340)
4900

2230
(3820)
36800

400
(200)
2700

250
(420)
3200

4770
(2770)
39300

89A

2480
(4240)
40000

1070
(1250)
10700

1410
(2990)
29300

1360
(1160)
10500

3410
(1610)
28800

1880
(1080)
12000

1140
(1880)
13400

5290
(2690)
40800

2550
(4870)
42700

SR 89

Larry Caldwell Dr

Granite Dells Pkwy

MATCH LINE
See Sheet 2 of 2

SR 89A (SR 89 To Fain Rd)

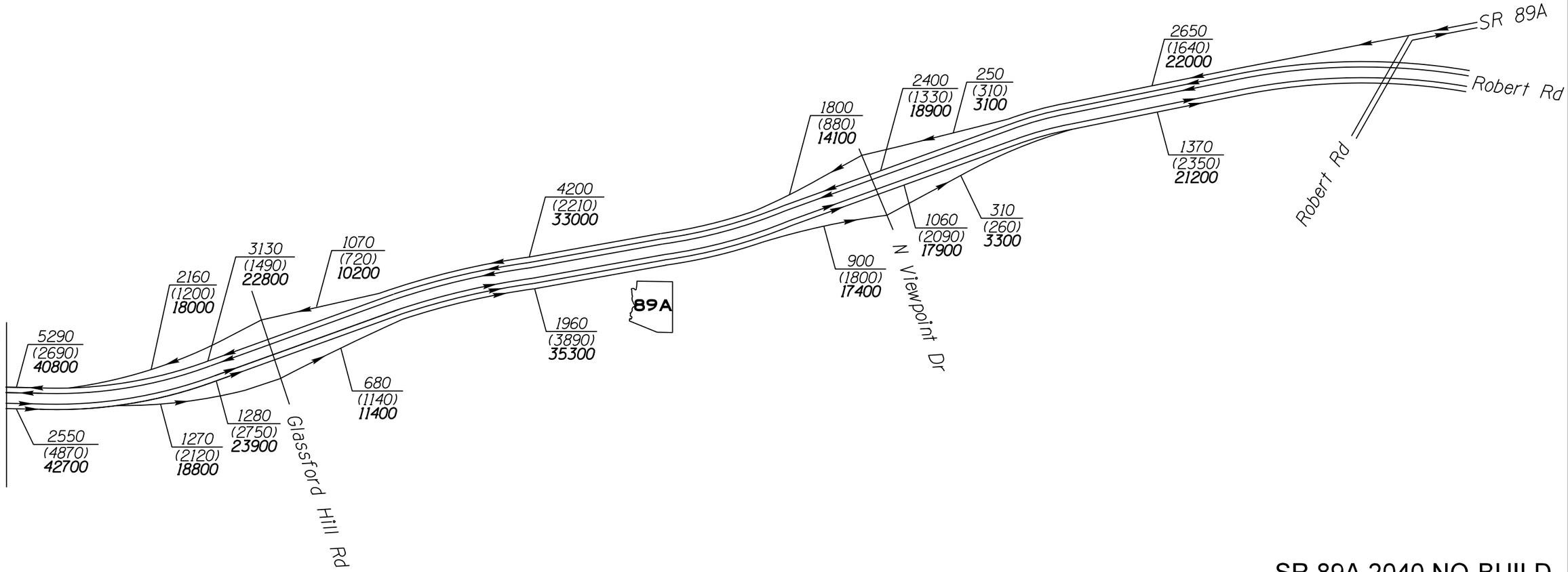
NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2040 NO-BUILD
VOLUMES AND LANE CONFIGURATION
SHEET 1 OF 2

11/7/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2040\No Build\SR89A Ramp Volumes 1_NB2040.dgn

LEGEND

XXX - 2040 AM Peak Hour Volumes
(XXX) - 2040 PM Peak Hour Volumes
XXXX - 2040 Average Daily Traffic



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

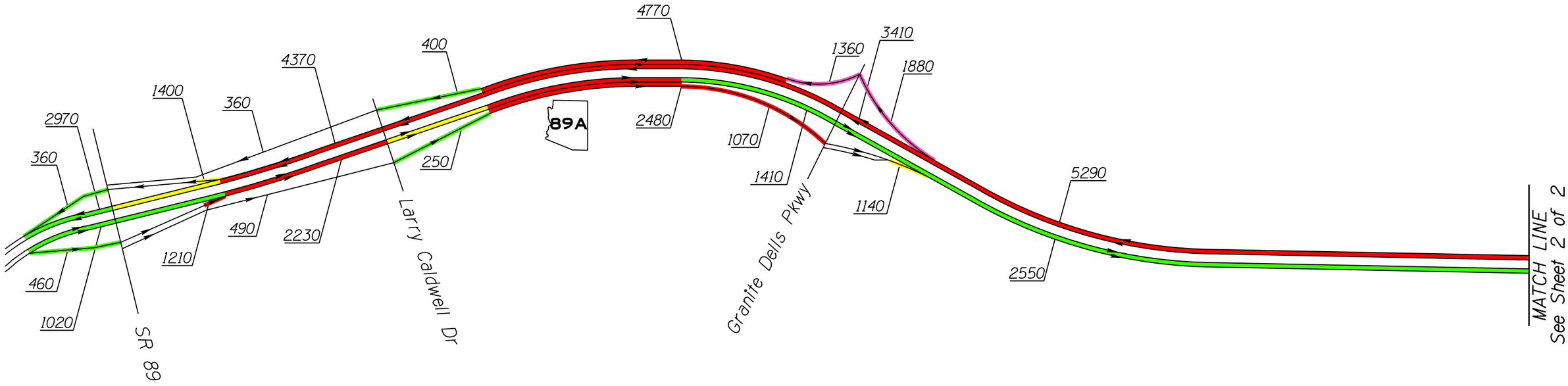
SR 89A 2040 NO-BUILD VOLUMES AND LANE CONFIGURATION SHEET 2 OF 2

LEGEND

XXX - 2040 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2040 NO-BUILD
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

11/7/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2040\No Build\SR89A 2040 NB LOS AM.dgn

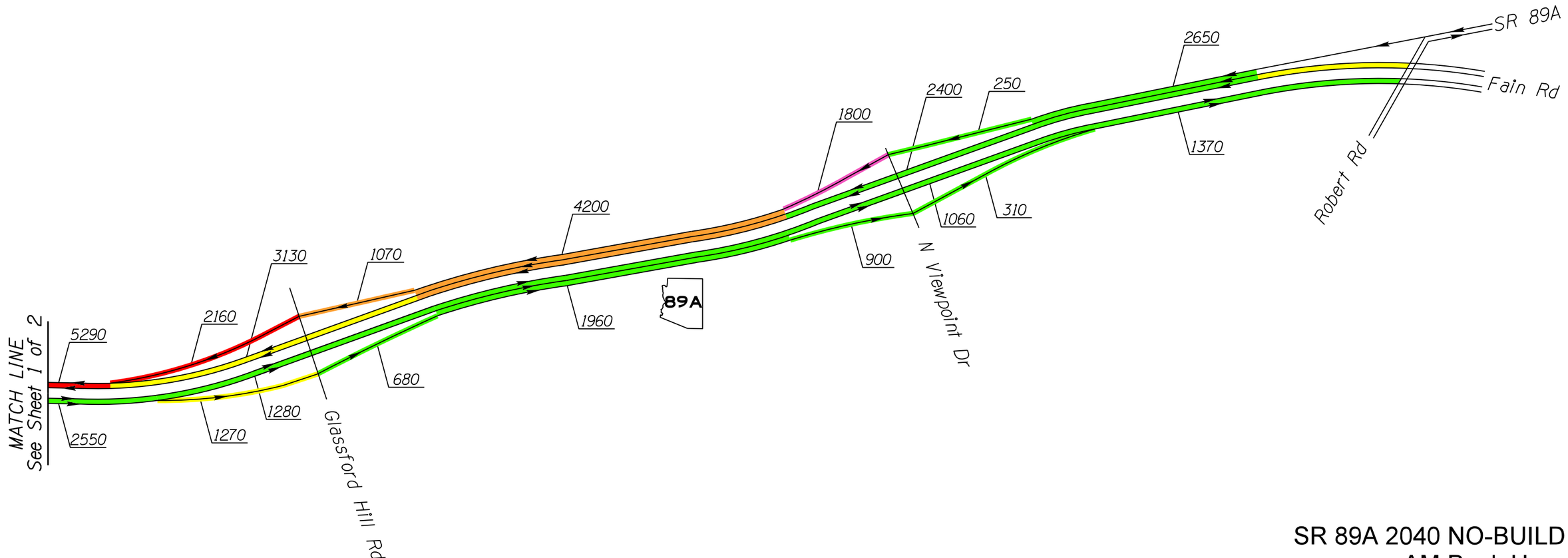
LEGEND

XXX - 2040 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2040 NO-BUILD
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

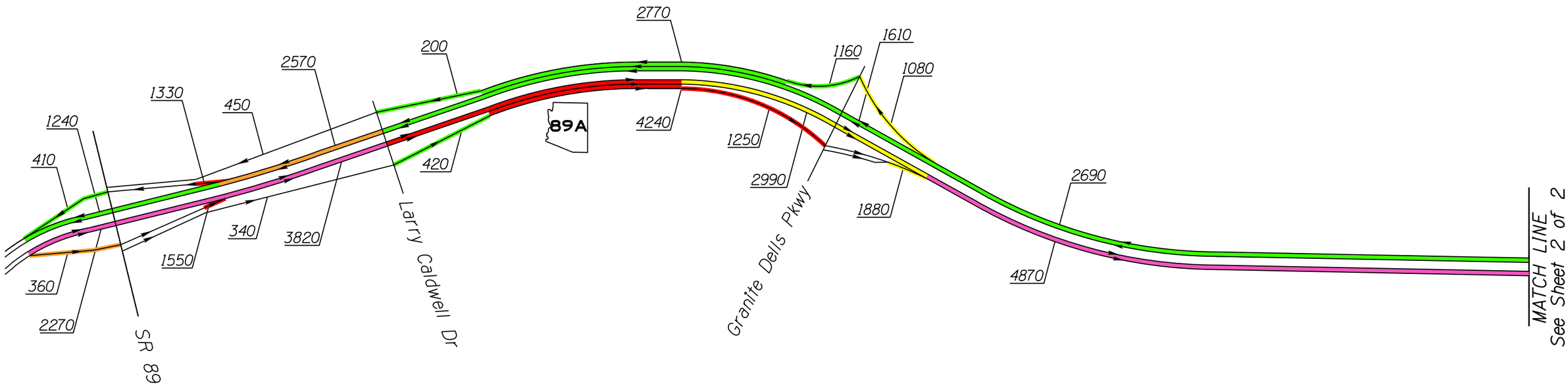
11/7/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2040\No Build\SR89A 2040 NB LOS AM 2.dgn

LEGEND

XXX - 2040 PM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2040 NO-BUILD
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

11/7/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2040\No Build\SR89A 2040 NB LOS PM.dgn

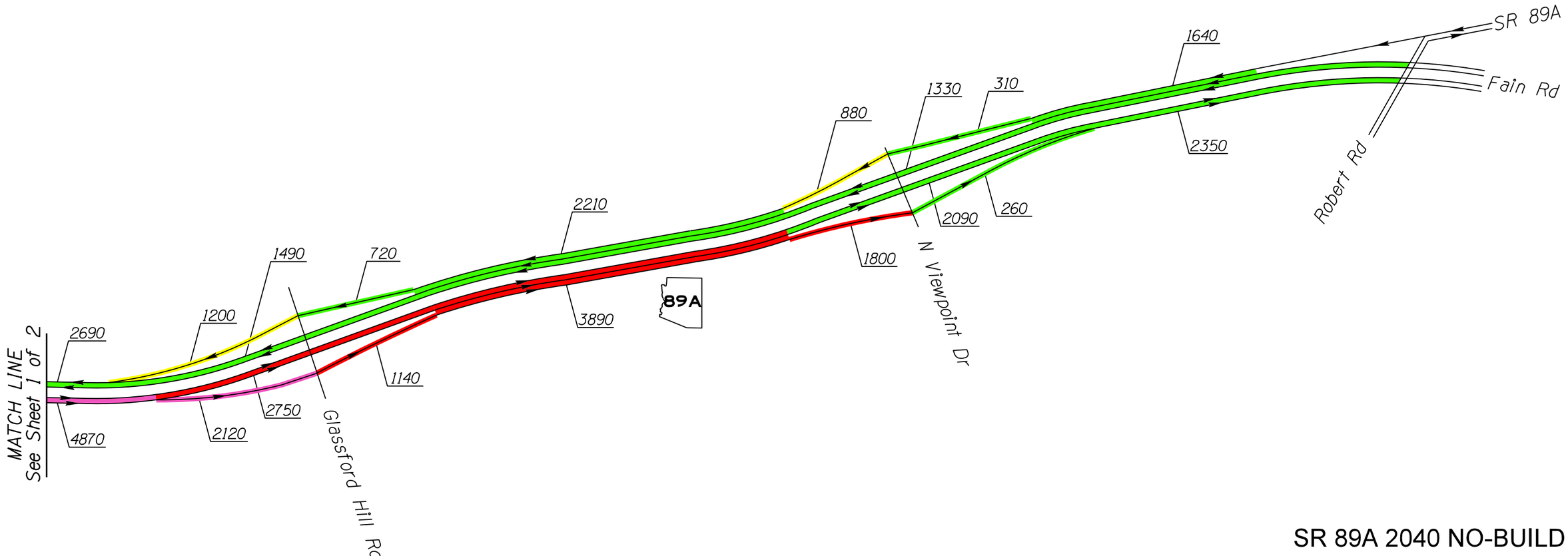
LEGEND

XXX - 2040 PM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N



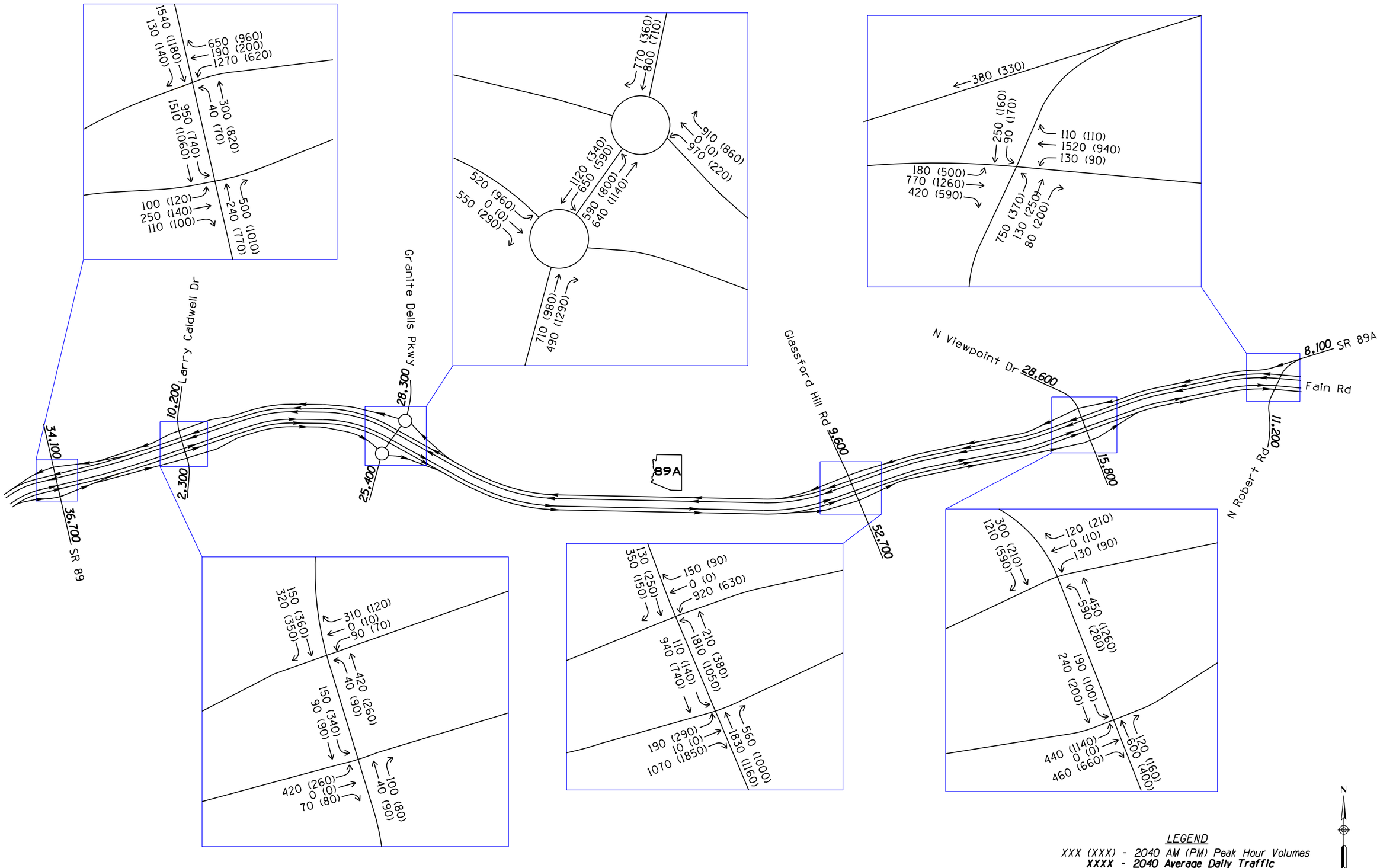
SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2040 NO-BUILD
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2040\No Build\SR89A 2040 NB LOS PM 2.dgn

11/7/2017

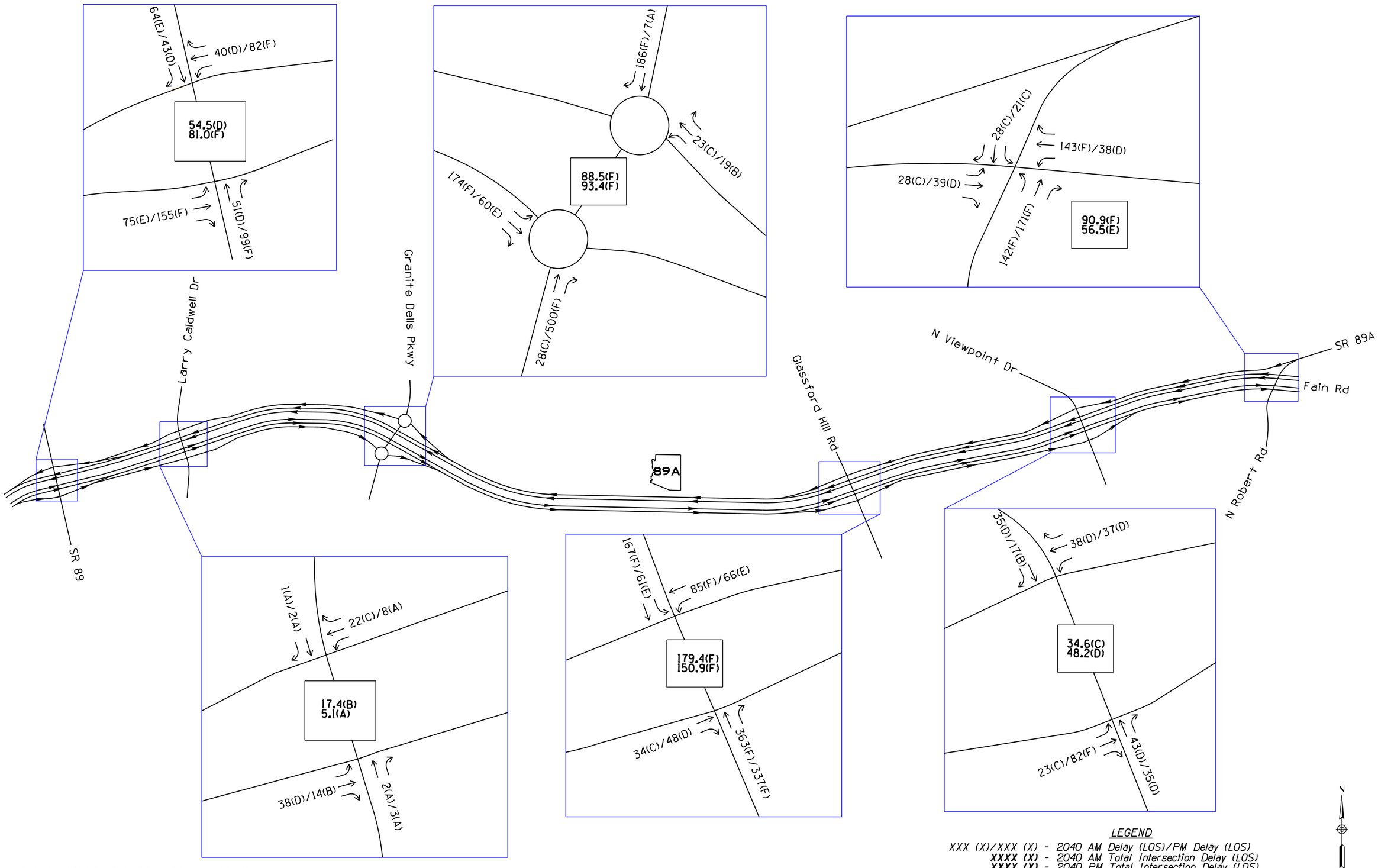


SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2040\No Build\SR89A 2040 NB Volume Diagram.dgn

11/7/2017



LEGEND

XXX (X)/XXX (X) - 2040 AM Delay (LOS)/PM Delay (LOS)
***XXXX (X)** - 2040 AM Total Intersection Delay (LOS)*
***XXXX (X)** - 2040 PM Total Intersection Delay (LOS)*

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2040\No Build\SR89A 2040 NB Int LOS Diagram.dgn

11/7/2017

Appendix 2 - Predictive Safety Analysis

Predictive Safety Analysis of Selected Improvements on the SR-89A Corridor

DRAFT

October 11, 2017

As a subconsultant to AECOM, Lee Engineering has conducted a predictive safety analysis for the SR-89A corridor, with the objective to rank selected improvements according to their safety benefit.

Safety improvements are often evaluated according to their Crash Modification Factor (CMF). A CMF represents the rate of expected change in crashes after implementing a roadway change. For instance, a CMF of 0.9 indicates that after the roadway change, crashes should be 90% as high as before the change. (A CMF of 0.9 translates to a 10 percent crash reduction.) CMFs can be established to apply to only certain crash types or severities. The *Highway Safety Manual*[1] and the Crash Modification Factors Clearinghouse[2] are the primary resources used to determine CMFs for this analysis.

While CMFs are a powerful analysis tool, they are typically taken from studies conducted at a variety of sites that may or may not have similar characteristics as the sites in the study corridor. As such, actual results could differ, either positively or negatively, from the CMF predictions.

Robert Road

Predictive safety analysis has been requested for three improvements at the intersection of Robert Rd. and SR-89A:

- Conversion of the signalized intersection to a roundabout
- Conversion of the signalized intersection to a grade-separated interchange
- Addition of a northbound left-turn lane (and possible related change to lane configuration) and installation of reflective backplates at the signal with signal modifications

The improvements are discussed below, in order of their expected safety benefit, from highest to lowest.

Roundabout

Many studies have documented the ability of roundabouts to help mitigate crashes. Roundabouts, in fact, are one of the "proven safety countermeasures"[3] recommended for implementation by the Federal Highway Administration as a safety mitigation measure.

The roundabout at Robert Road is proposed to have two circulating lanes; two-lane roundabouts often have more sources of conflict than single-lane roundabouts. Several CMFs address the conversion of signalized intersections to roundabouts, but only two studies provide CMFs to address the conversion of a signal to a two-lane roundabout. Both such studies[4,5] show the same CMF values, suggesting that they may have been drawn from the same source data.

The CMF for all crashes (in both studies) is 0.81, and the CMF for injury crashes is 0.29. This suggests that while total crashes may be reduced by about 19 percent, severe crashes could drop by 71 percent.

Robert Road experienced a total of 22 crashes over the recent 5-year period, or an average of 4.4 crashes per year. Of these, 12 were either injury or fatality crashes, and 10 involved property damage only. The CMFs suggest that annual severe crashes might be reduced from 2.4 to about 0.7, while total annual crashes could drop from 4.4 to about 3.6.

Grade-separated interchange

One study[6] determined CMFs associated with converting at-grade intersections to grade-separated interchanges; a variety of CMFs were determined according to the before and after characteristics. For the conversion of signalized intersections to a grade-separated interchange, this study determined a CMF for all crashes of 0.73 and a CMF for injury crashes of 0.72.

It should be noted that this study did not consider the type of grade-separated interchange, and certainly the interchange design can have a large impact of its safety performance. However, limits on the available data make it difficult to identify CMFs for specific interchange types.

Applying these CMF values to the crash pattern on Robert Road would suggest a reduction in annual injury crashes from 2.4 to about 1.7 and total annual crashes from 4.4 to about 3.2.

While the roundabout is expected to reduce total crashes by a smaller rate than the interchange, it is considered to have better overall safety performance than the grade-separated interchange because it is expected to reduce severe crashes by a greater rate.

Northbound left-turn lane

A comprehensive review of the CMF Clearinghouse revealed no crash modification factors associated with adding a left-turn lane on the minor street of a signalized interchange. However, in general, an increase in capacity on an intersection approach might be expected to reduce queuing on that approach

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[1] *Highway Safety Manual*, American Association of State Highway and Transportation Officials, 2010.
[2] Crash Modification Factors Clearinghouse, www.cmfclearinghouse.org.
[3] Proven Safety Countermeasures: Roundabouts. Federal Highway Administration, FHWA-SA-17-055
[4] Gross, F., Lyon, C., Persaud, B., Srinivasan, R., "Safety Effectiveness of Converting Signalized Intersections to Roundabouts." Presented at the 91st Annual Meeting of the Transportation Research Board, Paper No. 12-1658, Washington, DC (2012). Results also published in Accident Analysis and Prevention, Volume 50, January 2013, pages 234-241.
[5] Srinivasan, R., Baek, J., Smith, S., Sundstrom, C., Carter, D., Lyon, C., Persaud, B., Gross, F., Eccles, K., Hamidi, A., and Lefler, N., "NCHRP Report 705: Evaluation of Safety Strategies at Signalized Intersections.", Washington, D.C., Transportation Research Board, National Research Council, (2011). Presented at the Transportation Research Board 91st Annual Meeting, Paper No. 12-2521, January 22-26, 2012, Washington, DC.
[6] Elvik, R. and Erke, A., "Revision of the Hand Book of Road Safety Measures: Grade-separated junctions." (3-27-2007)

during congested periods. Rear-end collisions are often associated with extended queues, so reduction of queue length might normally help address a rear-end crash issue on an intersection approach.

The long cycle length at the intersection of Robert Rd. and SR-89A does lead to queues on the northbound approach at some times of day, but the queues have not resulted in crashes on this approach. The northbound approach (outside the intersection proper) experienced only one crash during the 5 years from 2011 through 2015, and this crash was not associated with queueing or congestion. It was a single-vehicle run-off-road crash that occurred at 8:12 p.m. on a Sunday, outside the traditional peak period.

The proposed left-turn lane would be created by restriping the existing pavement to accommodate a 3-lane approach instead of a 2-lane approach. This strategy will clearly provide a capacity benefit, but it could have a minor safety disbenefit, because it would eliminate the shoulder on the east side of Robert Road that currently serves as a refuge area for errant or disabled vehicles. However, conditions at the intersection are far different than a more isolated location, because drivers approaching the intersection are slowing for the traffic signal; familiar drivers are likely expecting to slow because the signal heavily favors mainline SR-89A traffic. The slow speeds and occasional queuing limit the shoulder's safety value. In addition, a well-graded unpaved shoulder is available just off the pavement that can provide almost the same benefit as the paved shoulder if the pavement is restriped as proposed.

Considering the lack of safety information in the literature about the northbound left-turn improvement, the very small number of existing crashes, and tendencies that might tend to both increase and decrease crashes, we believe it is appropriate to assume that this operational change will not have a significant effect on the intersection's safety performance. However, the installation of reflective backplates will have a CMF factor of 0.85 for all crashes. Applying this CMF value to the crash pattern on Robert Road would suggest a reduction in total annual crashes from 4.4 to about 3.8.

Summary of Robert Road countermeasures

Countermeasure	*CMF*		*Predicted annual crash reduction*	
	All crashes	*Severe crashes*	*All crashes*	*Injury crashes*
Roundabout	0.81	0.29	0.8	1.7
Interchange	0.73	0.72	1.2	0.7
NB left-turn lane & Reflective backplates	0.85	*	0.6	*

* No CMF is available for this countermeasure for sever crashes, but it is expected that it would result in an insignificant change in safety performance.

Glassford Hill Road

Predictive safety analysis has been conducted for the following improvements at the interchange of Glassford Hill Road and SR-89A:

- Converting the existing signalized interchange ramp termini to roundabout control
- Converting the existing conventional diamond interchange to a diverging diamond interchange (DDI)
- Converting the existing eastbound right-turn lane to a free right
- Constructing a new interchange between Glassford Hill Rd. and Granite Dells Pkwy.

These improvements are discussed in order of their expected safety benefit, from highest to lowest.

Roundabout ramp termini

From a safety perspective, conversion of the Glassford Hill interchange ramp termini signals to roundabouts is nearly identical to conversion of the Robert Road intersection to a roundabout. In both cases, the intersections start with signal control and are proposed to be converted to roundabouts with two circulating lanes. The Glassford Hill roundabouts are expected to operate with better safety performance than the Robert Road roundabout, because approach speeds and conflicts are reduced by virtue of the integration with the one-way interchange ramps. However, these details are not captured by the CMFs.

The CMFs noted above continue to apply to the Glassford Hill interchange: the CMF for all crashes is 0.81, and the CMF for injury crashes is 0.29.

Crash data show that the Glassford Hill interchange in its entirety experienced 52 crashes during the recent 5-year period, an average of 10.4 per year, but many of these crashes occurred on the entrance or exit ramps or other areas of the interchange not subject to correction by the roundabout ramp termini. At the interchange termini, the north intersection experienced 4 crashes in a 5-year period and the south intersection experienced 16 crashes during the same period. In addition, 9 crashes occurred on the northbound approach to the interchange, near enough to the signalized ramp terminus (within about 500 feet) that they can be considered related to the ramp terminus queuing. In all, 29 crashes occurred on Glassford Hill Rd. at or near one of the ramp termini, an average of 5.8 per year.

Of these 29 crashes, only 6 involved injuries, suggesting that motorists' low speeds are helping to keep injury severity relatively low.

According to the CMFs, the roundabout termini would be expected to reduce annual injury crashes from 1.2 to about 0.3 and total annual crashes from 5.8 to 4.7.

Diverging Diamond Interchange

A Diverging Diamond Interchange (DDI) is characterized by the two directions of mainline traffic crossing each other's paths on either side of the interchange. The configuration can reduce the number of signal phases at an interchange and can provide operational benefits when interchange turning volumes are high relative to mainline through volume.

While DDIs are uncommon in the U.S., one study[7] has attempted to develop a CMF for converting a conventional diamond interchange to a DDI. The safety benefits accrue from the reduction in conflict points, slower speeds through the interchange, and simplified turning movements. The DDI shows a CMF of 0.67 for all crashes and 0.59 for severe crashes.

Applying these CMFs to the Glassford Hill crash pattern at the ramp termini, it is expected that annual injury crashes could be reduced from 1.2 to about 0.7 and total annual crashes from 5.8 to 3.9.

The roundabout interchange and the DDI have similar crash reduction capabilities, though the roundabouts are somewhat more effective at reducing severe crashes and the DDI can better reduce overall crashes. It would be possible to rank these alternatives in the reverse order depending on the assumed ratio of cost of an injury crash to cost of a property damage crash.

Eastbound free right-turn lane

If the existing signalized ramp termini are maintained, it has been suggested that the eastbound right-turn lane on the SR-89A exit ramp could be converted to free operation, in which a stop or yield would not be required because the lane would feed a dedicated receiving lane on southbound Glassford Hill Rd.

Two CMFs were identified as potentially relevant to this improvement, but neither provided an exact match. One study evaluated the addition of a right-turn lane at a stop-controlled intersection, but it was discarded because the Glassford Hill ramp termini are signal-controlled. A second study[8] considered the addition of a right-turn lane on a major road approach to a traffic signal, but did not consider whether the lane would operate as a free right.

This study showed a CMF of 0.96 for all crashes and 0.91 for severe crashes. This improvement could only be expected to improve crashes at the south intersection within the interchange, and likely would not have any impact on crashes on the northbound approach. As noted earlier, a total of 16 crashes occurred at the south interchange over a 5-year period, and of these, only 3 involved injury. An additional 3 crashes occurred on the eastbound approach to the intersection, coded about 200 feet upstream of the stop bar, such that they may be related to queuing on the eastbound approach. Two of these three crashes involved an injury. In sum, a total of 19 crashes and 5 injury crashes occurred at or approaching the south intersection in the Glassford Hill interchange.

As such, these CMFs would suggest that severe annual crashes could be reduced from 1.0 to 0.9, and total annual crashes could be reduced from 3.8 to 3.6.

[7] Hummer, J.E., D., C.M. Cunningham, R. Srinivasan, S. Warchol, B. Claros, P. Edara, and C. Sun. "Safety Evaluation of Seven of the Earliest Diverging Diamond Interchanges Installed in the US". Presented at the 95th Annual Meeting of the Transportation Research Board, Paper No. 16-5481, Washington, D.C., (2016).

[8] Harwood, D. W., Bauer, K. M., Potts, I. B., Torbic, D. J., Richard, K. R., Rabbani, E. R., Hauer, E., Elefteriadou, L., and Griffith, M. S., "Safety Effectiveness of Intersection Left- and Right-Turn Lanes." Washington, D.C., 82nd Transportation Research Board Annual Meeting, (2003)

In general, it is expected that free-right operation would improve safety performance more than a conventional right-turn lane because it could help reduce queues during congested periods. However, only three crashes occurred on the eastbound approach in a 5-year period, which suggests that the potential for safety improvement by reducing this crash type is quite limited.

Adjacent Interchange

A new interchange (the Great Western TI) has been proposed as an alternative to be constructed between the existing Glassford Hill and Granite Dells interchanges. A new interchange would primarily help to relieve traffic from the existing interchanges, reducing the traffic volume without any other roadway safety improvements.

A review of the CMF Clearinghouse found no CMFs at an interchange associated with the construction of a nearby interchange.

Historically, crashes have been evaluated using a crash rate, often the number of crashes per million vehicle miles traveled. This formulation assumes that the crash rate is essentially constant for a given roadway condition, such that if traffic increases or decreases by a certain percentage, crashes will increase or decrease by the same percentage.

This strategy is not perfectly accurate, particularly because of the relationship between congestion and crashes. If traffic volume increases a small amount but crosses a threshold between uncongested and congested conditions, crashes may increase by a much larger amount. This effect can be captured by more modern measures of safety performance, such as Safety Performance Functions (SPFs).

However, for a broad improvement such as a new interchange, the crash rate formulation can be helpful to understand overall safety patterns. If crashes are linearly related to traffic volume, then it could be expected that if a new interchange could reduce traffic volume at the Glassford Hill interchange by a set percentage, then it could also be expected to reduce crashes by the same percentage. (At some times of day, the crash reduction might be expected to exceed the volume reduction, particularly during congested times.)

While this formulation suggests a reduction in crashes at the Glassford Hill interchange, crashes are likely to occur at the proposed interchange as well. The proposed interchange might have ramp termini with better safety performance than Glassford Hill (such as roundabouts), and if so the total number of crashes at the two interchanges may be reduced slightly. However, the new interchange will also introduce two new exit gores and two new entrance gores, merging, diverging, and (possibly) weaving areas on the mainline, all of which are potentially new sources of crashes beyond current conditions.

As such, while a new interchange is likely to provide much improved corridor mobility and traffic operations, it is not clear at this time that it would have a significant overall impact on safety performance.

Summary of Glassford Hill Road countermeasures

Countermeasure	*CMF*		*Predicted annual crash reduction*	
	All crashes	*Severe crashes*	*All crashes*	*Injury crashes*
Roundabouts	0.81	0.29	1.1	0.9
DDI	0.67	0.59	1.9	0.5
EB free right	0.96	0.91	0.2	0.1
Great Western TI	*	*	*	*

* No CMF is available for this countermeasure, but it is expected that it would result in an insignificant change in safety performance.

Granite Dells Parkway

Two safety countermeasures have been suggested for the interchange of Granite Dells Parkway with SR-89A:

- Modifying the lane configuration and alignment at the roundabout
- Constructing a new interchange between Glassford Hill Rd. and Granite Dells Pkwy.

Roundabout Lane Configuration

The Granite Dells interchange ramp termini are controlled by roundabouts, each of which has two circulating lanes, except that they have only a single circulating lane for crossroad U-turns, a very low-volume movement. A change to the lane configuration and alignment has been recommended to address traffic operational concerns in the future.

Such a change is difficult to address using a predictive safety analysis. A review of the CMF Clearinghouse did not identify any CMFs associated with a change in the lane configuration and alignment of a roundabout.

Furthermore, the interchange has little traffic today, though its volume is projected to increase considerably in future years. The low current volume translates to excellent existing safety performance. No crashes occurred at either of the Granite Dells interchange terminus roundabouts during the recent 5-year period. It is difficult to apply any factor or rate to crash conditions when the existing conditions start with perfect safety performance.

Qualitatively, the recommended change to slow traffic approaching the roundabout using a series of reverse curves should tend to improve safety, because it is imperative that drivers approach and traverse a roundabout at reasonable speeds to maximize safety. It is not possible to improve on the perfect safety record from 2011 to 2015, but as volume increases in the future, it is likely that crashes may begin to occur as well, and the reverse curves can better position the roundabouts to continue their excellent safety performance.

Unfortunately, the lack of available CMF data or any existing crashes make it difficult to quantify the effects on safety. In general, it is expected that a change to lane configuration and alignment would have a small impact on crashes.

Adjacent Interchange

The adjacent interchange was discussed earlier, and the same discussion applies to Granite Dells as to Glassford Hill. The lack of crashes at the existing Granite Dells roundabouts further complicates the ability to evaluate the safety impact of an adjacent interchange.

Summary of Granite Dells Parkway countermeasures

Countermeasure	*CMF*		*Predicted annual crash reduction*	
	All crashes	*Severe crashes*	*All crashes*	*Injury crashes*
Change in lane configuration	*	*	*	*
Great Western TI	*	*	*	*

* No CMF is available for this countermeasure, but it is expected that it would result in an insignificant change in safety performance.

Appendix 3 - 2025-2035 Build Volumes and Configurations

LEGEND

XXX - 2025 AM Peak Hour Volumes
(XXX) - 2025 PM Peak Hour Volumes
XXXX - 2025 Average Daily Traffic

N

1830
(770)
12200

250
(250)
3100

280
(250)
3100

600
(1440)
12300

SR 89

1110
(980)
12000

230
(410)
4500

910
(1000)
12000

2960
(1750)
24200

290
(210)
3200

1510
(2440)
24300

290
(90)
2100

130
(290)
2200

Larry Caldwell Dr

89A

3250
(1840)
26300

1640
(2730)
26500

400
(460)
4200

380
(420)
3800

1260
(2310)
22700

2850
(1380)
22100

430
(460)
4600

510
(410)
4600

Granite Dells Pkwy

3360
(1790)
26700

1690
(2770)
27300

MATCH LINE
See Sheet 2 of 2

SR 89A 2025 RECOMMENDED
VOLUMES AND LANE CONFIGURATION
SHEET 1 OF 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

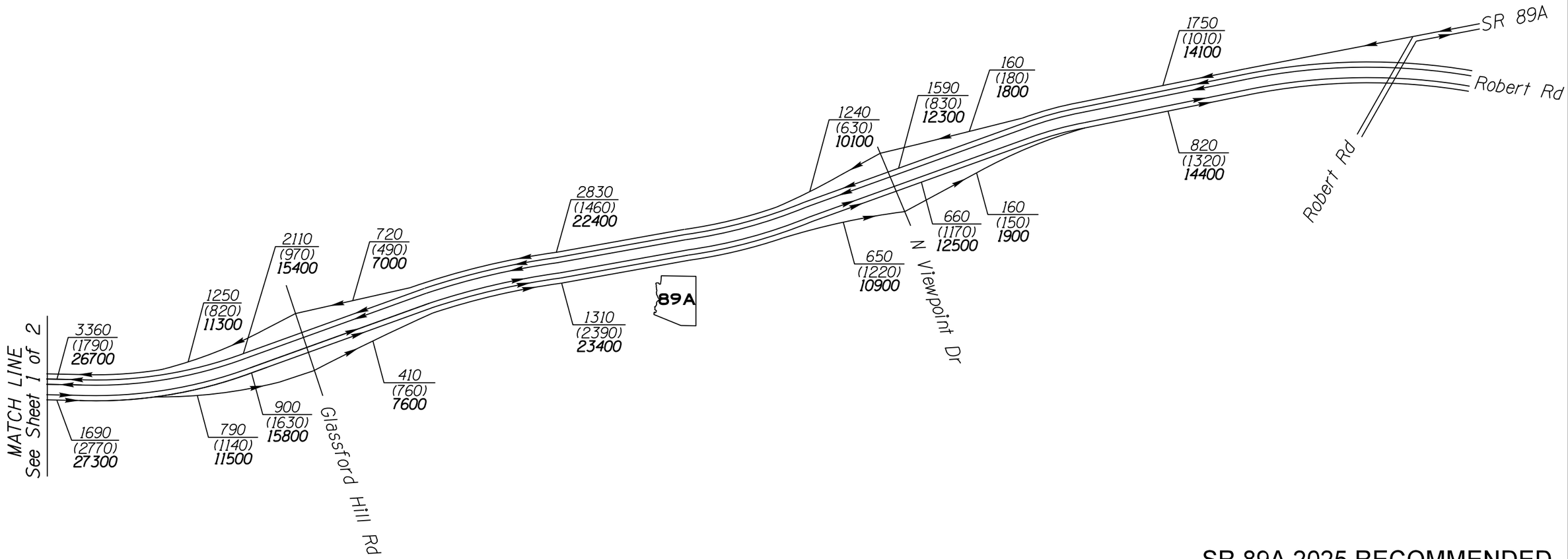
12/5/2017

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\Build\SR89A Ramp Volumes 1_Build_2025.dgn

LEGEND

XXX - 2025 AM Peak Hour Volumes
(XXX) - 2025 PM Peak Hour Volumes
XXXX - 2025 Average Daily Traffic

N



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2025 RECOMMENDED VOLUMES AND LANE CONFIGURATION SHEET 2 OF 2

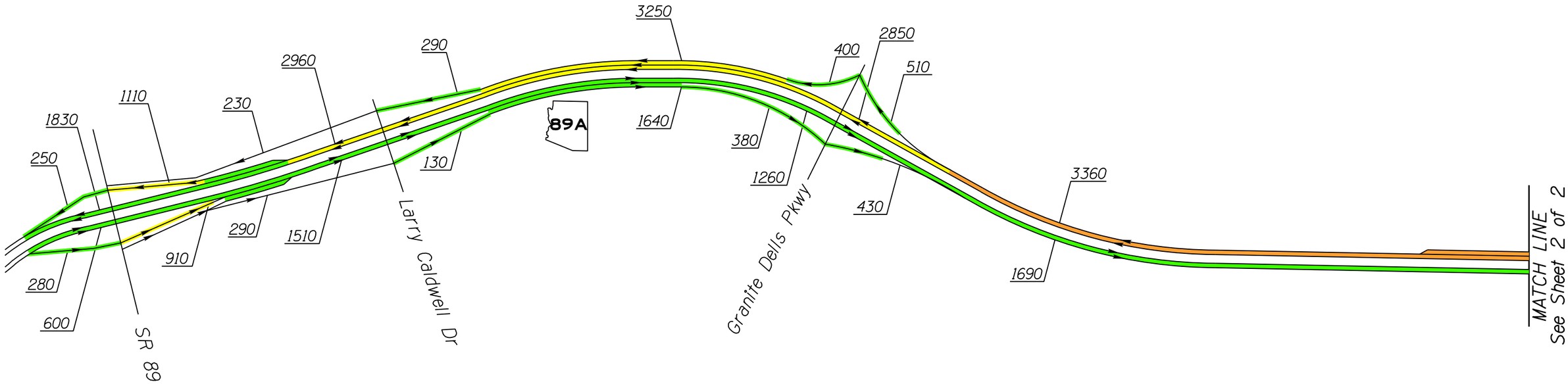
12/5/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\Build\SR89A Ramp Volumes 2_Build_2025.dgn

LEGEND

XXX - 2025 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2025 RECOMMENDED
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

12/5/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\Build\SR89A 2025 Build_LOS AM.dgn

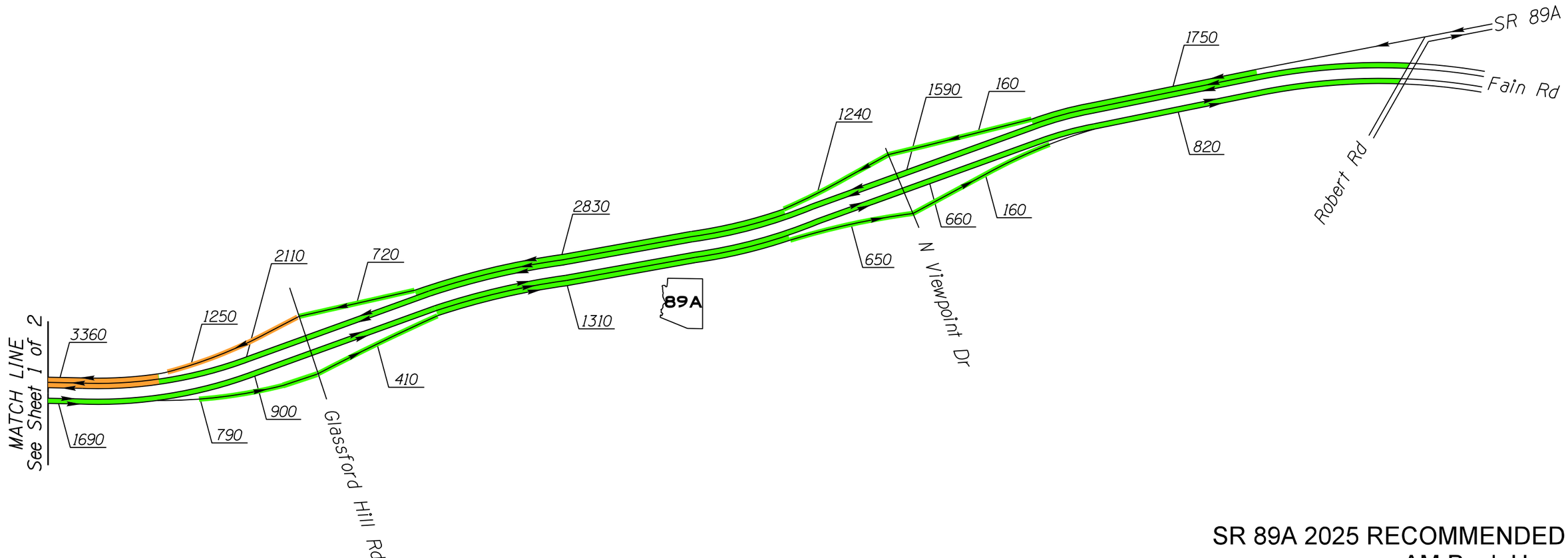
LEGEND

XXX - 2025 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2025 RECOMMENDED
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

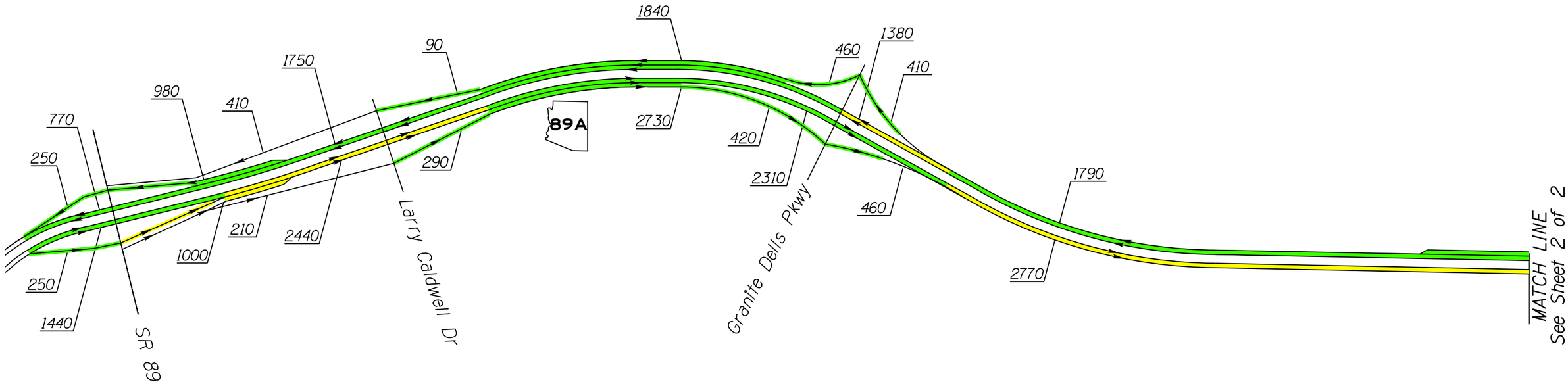
12/5/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\Build\SR89A 2025 Build_LOS AM 2.dgn

LEGEND

XXX - 2025 PM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2025 RECOMMENDED
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

12/5/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\Build\SR89A 2025 Build_LOS PM.dgn

LEGEND

XXX - 2025 PM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N

SR 89A

Fain Rd

Robert Rd

N Viewpoint Dr

Glassford Hill Rd

89A

1010
830
180
630
1320
1460
1170
150
1220
970
490
2390
820
1790
760
1630
1140
2770

MATCH LINE
See Sheet 1 of 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

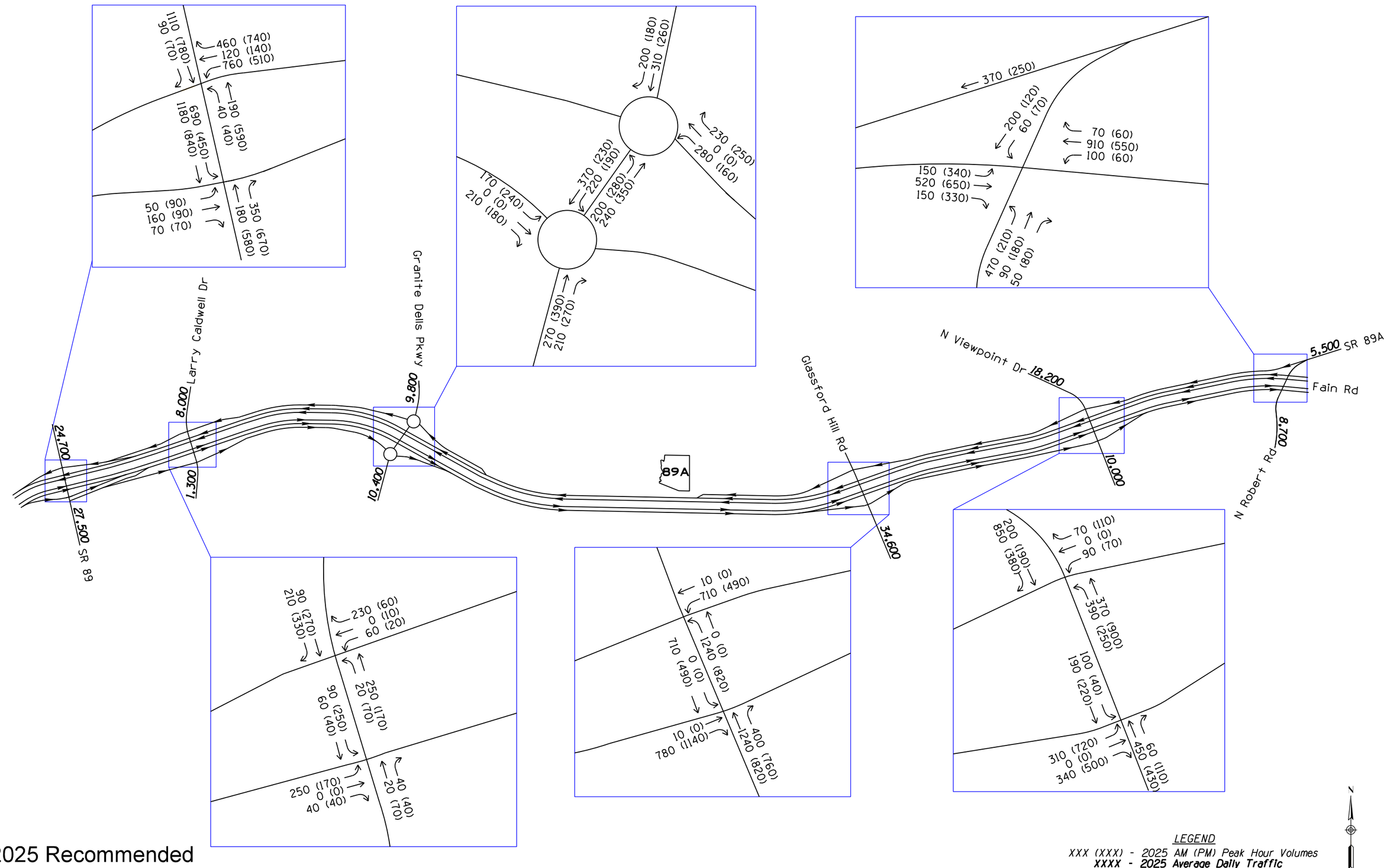
SR 89A 2025 RECOMMENDED
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

12/5/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\Build\SR89A 2025 Build_LOS PM 2.dgn

P:\Projects\ADOT\ADOT_IPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\Build\SR89A 2025 Build_ Volume Diagram.dgn

12/5/2017

2025 Recommended
SR 89A (SR 89 To Fain Rd)



NOT TO SCALE - SCHEMATIC ONLY

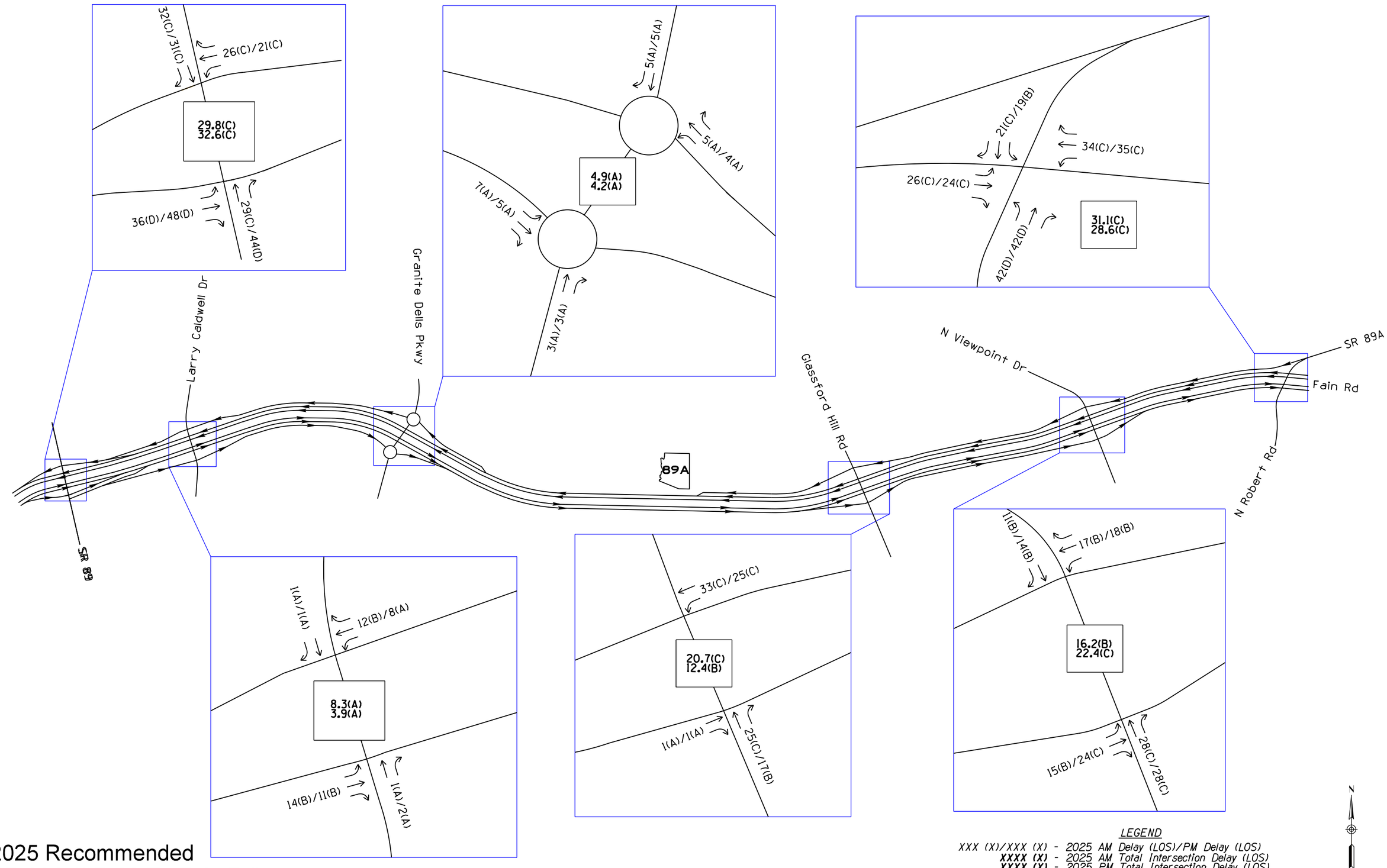
LEGEND

XXX (XXX) - 2025 AM (PM) Peak Hour Volumes
XXXX - 2025 Average Daily Traffic

P:\Projects\ADOT\ADOT_IPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2025\Build\SR89A 2025 Build Int LOS Diagram.dgn

12/5/2017

2025 Recommended
SR 89A (SR 89 To Fain Rd)



LEGEND

XXX (X)/XXX (X) - 2025 AM Delay (LOS)/PM Delay (LOS)
***XXXX (X)** - 2025 AM Total Intersection Delay (LOS)*
***XXXX (X)** - 2025 PM Total Intersection Delay (LOS)*

NOT TO SCALE - SCHEMATIC ONLY

LEGEND

XXX - 2030 AM Peak Hour Volumes
(XXX) - 2030 PM Peak Hour Volumes
XXXX - 2030 Average Daily Traffic

N

2340
(900)
14600

1200
(1070)
13800

290
(290)
3600

300
(270)
3600

780
(1840)
14800

SR 89

300
(420)
4500

3540
(1970)
28400

980
(1090)
13700

340
(280)
3800

1760
(2930)
28500

320
(120)
2300

150
(310)
2500

Larry Caldwell Dr

89A

3860
(2090)
30700

1910
(3240)
31000

760
(690)
6300

690
(730)
6400

1220
(2510)
24600

Granite Dells Pkwy

3100
(1400)
24400

900
(730)
7000

780
(780)
7800

4000
(2130)
31400

2000
(3290)
32400

MATCH LINE
See Sheet 2 of 2

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\Build\SR89A Ramp Volumes 1.Build.2030.dgn

12/5/2017

SR 89A (SR 89 To Fain Rd)

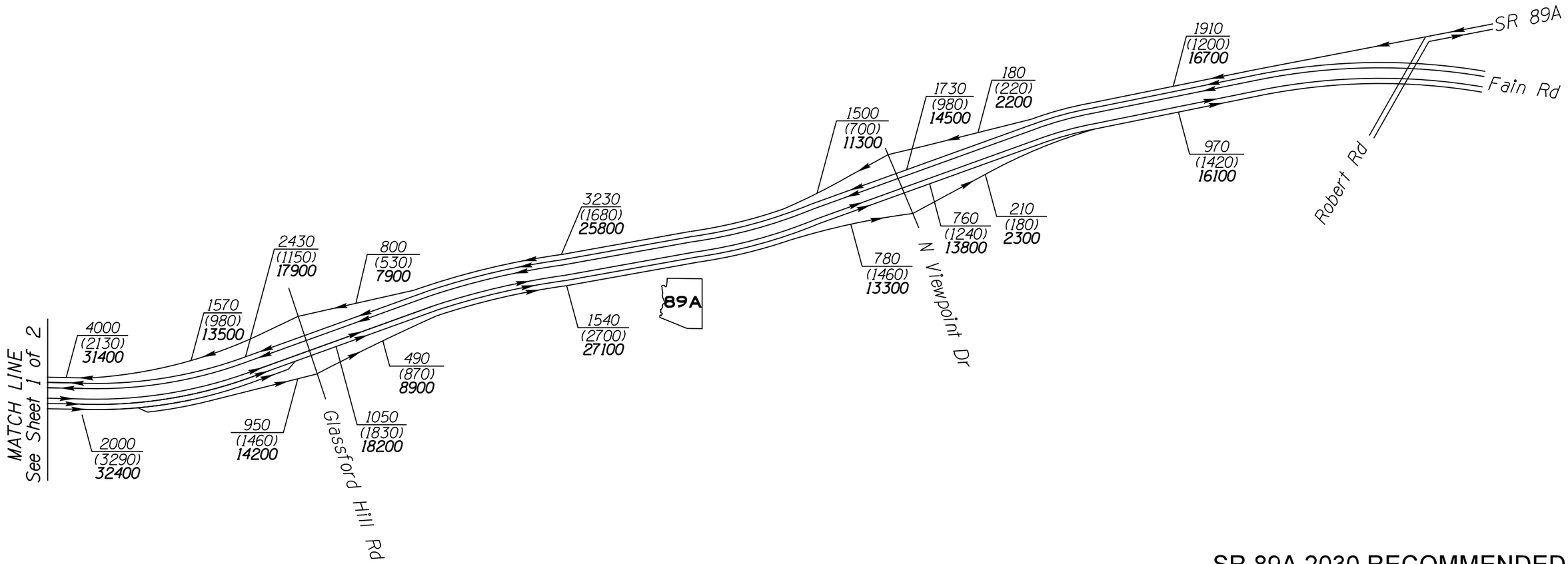
NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2030 RECOMMENDED VOLUMES AND LANE CONFIGURATION

SHEET 1 OF 2

LEGEND

XXX - 2030 AM Peak Hour Volumes
(XXX) - 2030 PM Peak Hour Volumes
XXXX - 2030 Average Daily Traffic



SR 89A 2030 RECOMMENDED
VOLUMES AND LANE CONFIGURATION
SHEET 2 OF 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

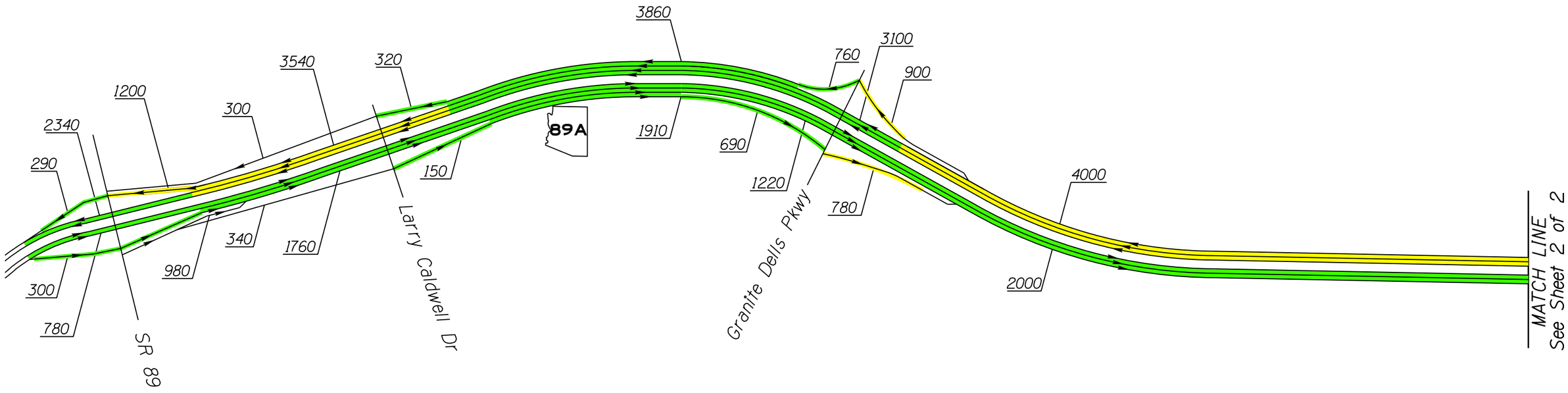
12/5/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\Build\SR89A Ramp Volumes 2_Build_2030.dgn

LEGEND

XXX - 2030 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2030 RECOMMENDED
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

12/5/2017

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\Build\SR89A 2030 Build_LOS AM.dgn

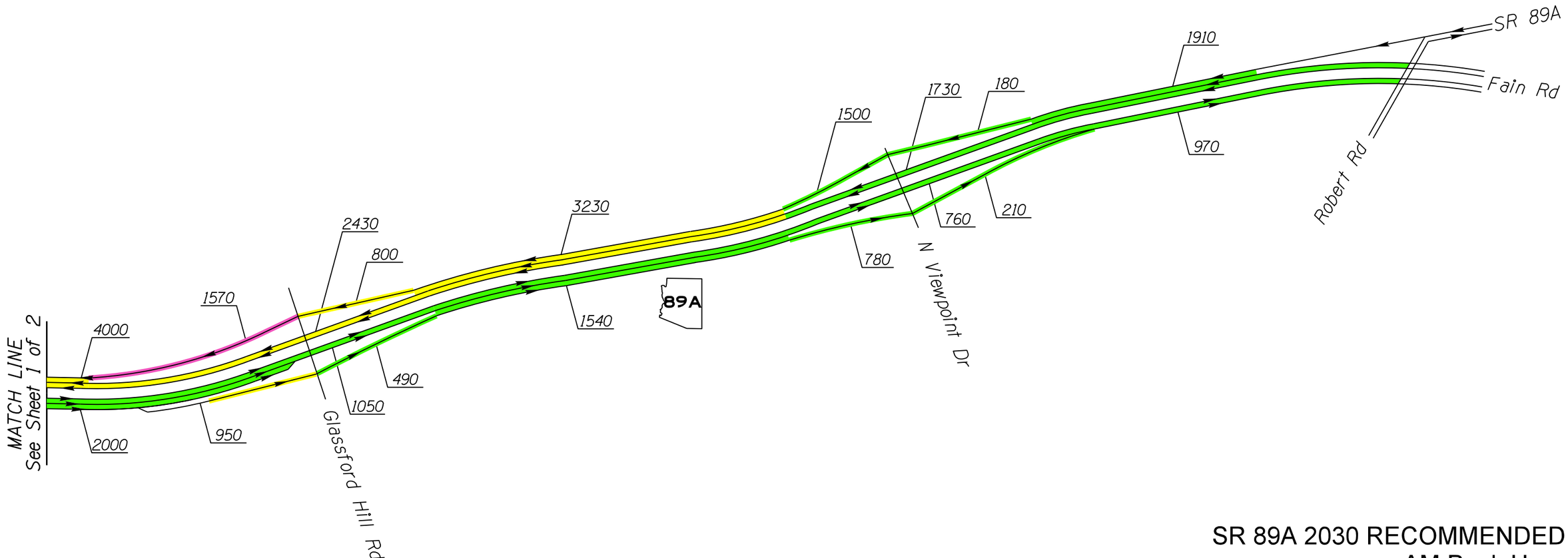
LEGEND

XXX - 2030 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2030 RECOMMENDED
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

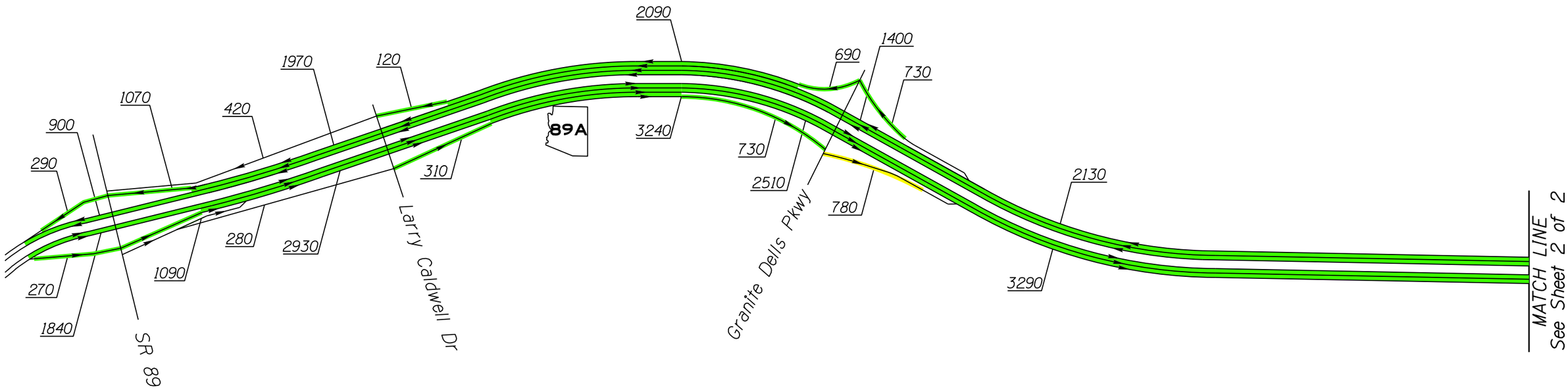
12/5/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\Build\SR89A 2030 Build LOS AM 2.dgn

LEGEND

XXX - 2030 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2030 RECOMMENDED
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

12/5/2017

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\Build\SR89A 2030 Build LOS PM.dgn

LEGEND

XXX - 2030 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2030 RECOMMENDED
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

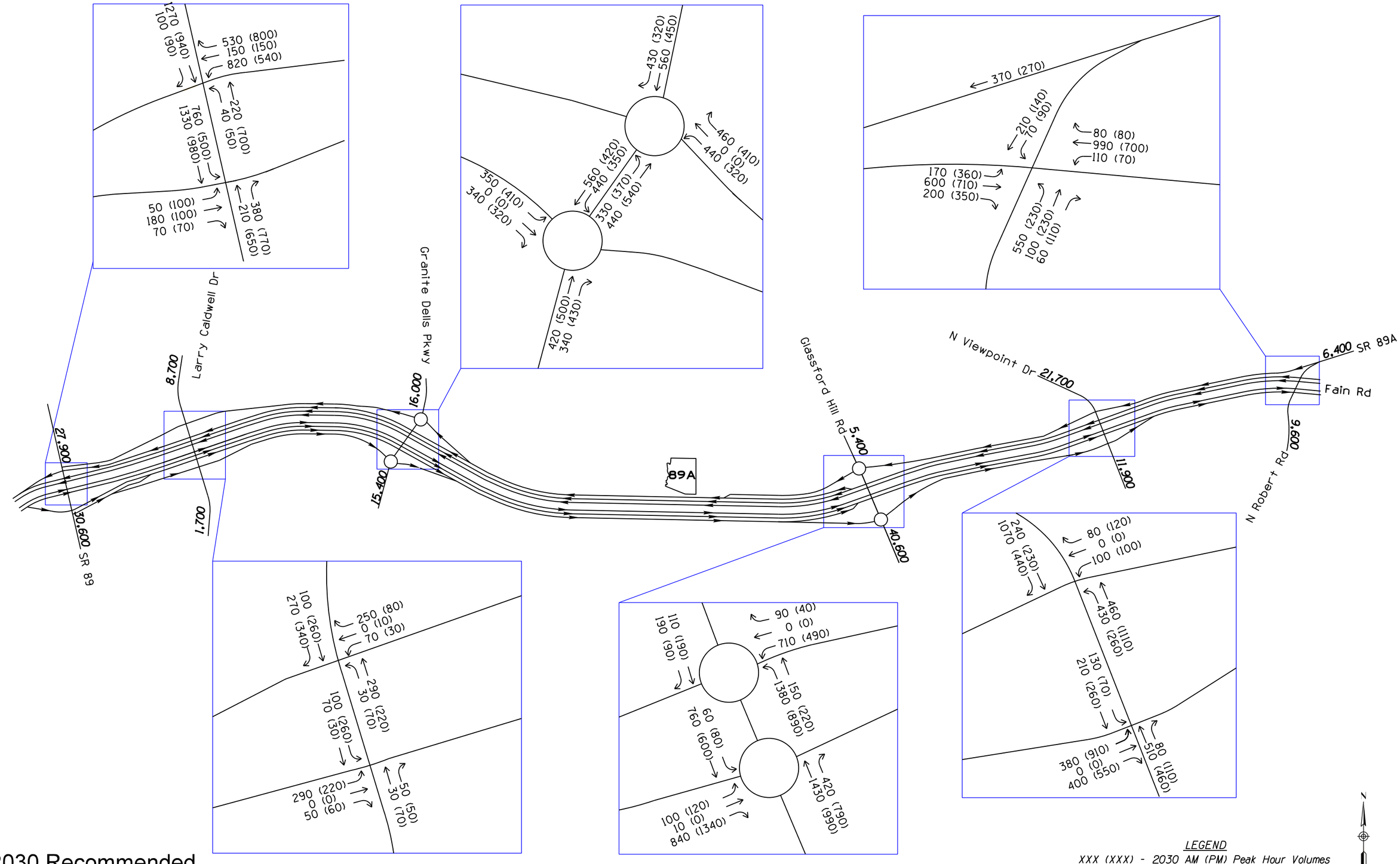
12/5/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\Build\SR89A 2030 Build LOS PM 2.dgn

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\Build\SR89A 2030 Build Volume Diagram.dgn

12/5/2017

2030 Recommended
SR 89A (SR 89 To Fain Rd)

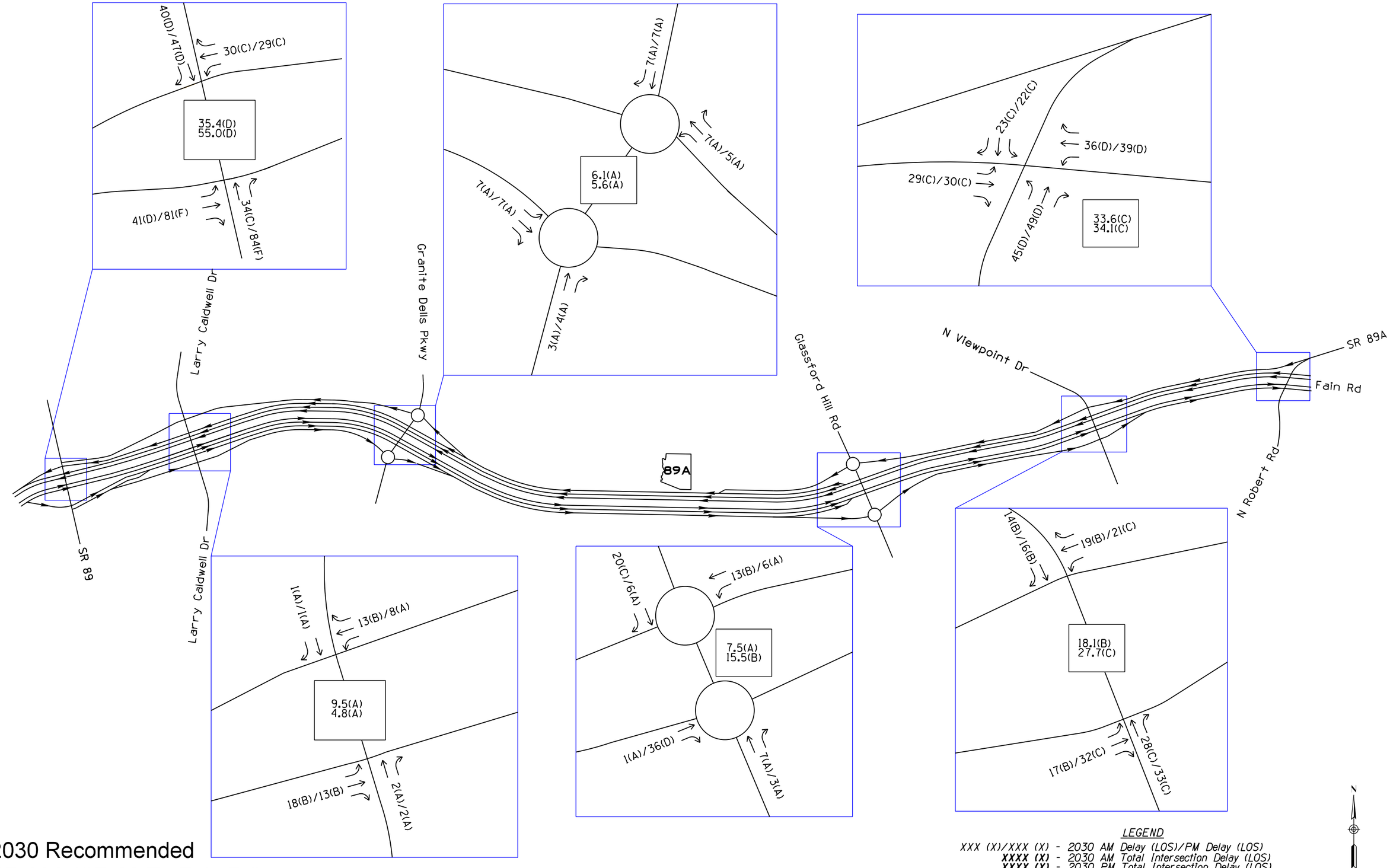
NOT TO SCALE - SCHEMATIC ONLY



LEGEND

XXX (XXX) - 2030 AM (PM) Peak Hour Volumes

XXXX - 2030 Average Daily Traffic



2030 Recommended
SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

LEGEND

XXX (X)/XXX (X) - 2030 AM Delay (LOS)/PM Delay (LOS)
***XXXX (X)** - 2030 AM Total Intersection Delay (LOS)*
***XXXX (X)** - 2030 PM Total Intersection Delay (LOS)*

12/5/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2030\Build\SR89A 2030 Build_Int_LOS Diagram.dgn

LEGEND

XXX - 2035 AM Peak Hour Volumes
(XXX) - 2035 PM Peak Hour Volumes
XXXX - 2035 Average Daily Traffic

N

2670 (1080) **16900**
1300 (1170) **15400**
320 (320) **4000**
340 (310) **4000**
840 (2030) **17300**
SR 89
360 (430) **4500**
3970 (2250) **32300**
1070 (1180) **15300**
410 (320) **4300**
1910 (3210) **32600**
370 (160) **2400**
200 (350) **2900**
Larry Caldwell Dr
4340 (2410) **34700**
89A
2110 (3560) **35500**
600 (600) **6000**
1510 (2960) **29500**
Granite Dells Pkwy
800 (800) **8000**
590 (570) **4900**
3750 (1840) **29800**
800 (590) **7000**
4550 (2430) **36800**
2310 (3760) **37500**
850 (580) **7500**
680 (900) **7500**
630 (2860) **30000**
Great Western Dr
3700 (1850) **29300**
560 (940) **5100**
480 (590) **5600**
MATCH LINE
See Sheet 2 of 2

SR 89A (SR 89 To Fain Rd)

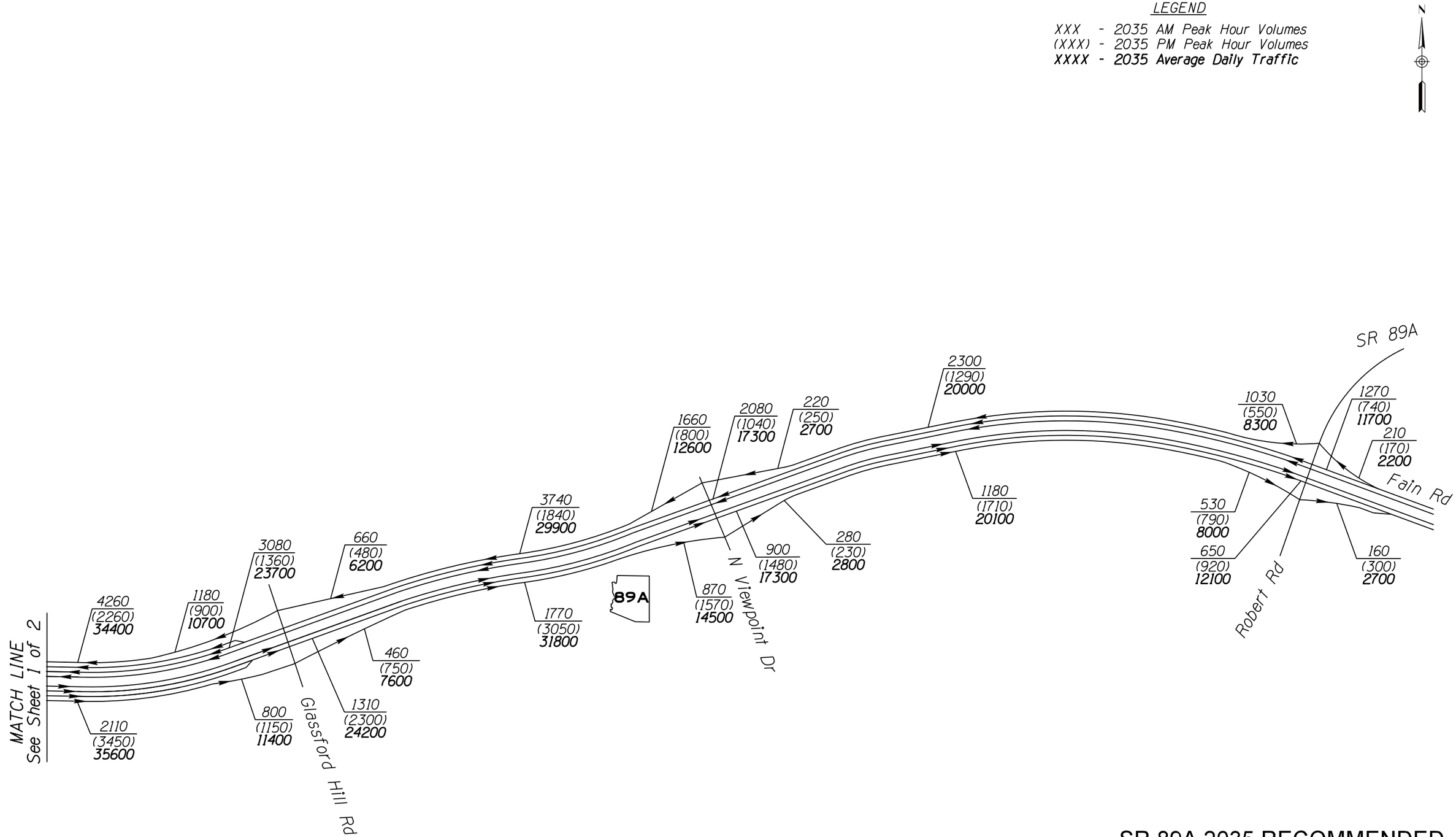
NOT TO SCALE - SCHEMATIC ONLY

SR 89A 2035 RECOMMENDED VOLUMES AND LANE CONFIGURATION SHEET 1 OF 2

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\Build\SR89A Ramp Volumes 1.Build.2035.dgn
12/5/2017

LEGEND

XXX - 2035 AM Peak Hour Volumes
(XXX) - 2035 PM Peak Hour Volumes
XXXX - 2035 Average Daily Traffic



SR 89A 2035 RECOMMENDED
VOLUMES AND LANE CONFIGURATION
SHEET 2 OF 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\Build\SR89A Ramp Volumes 2_Build_2035.dgn

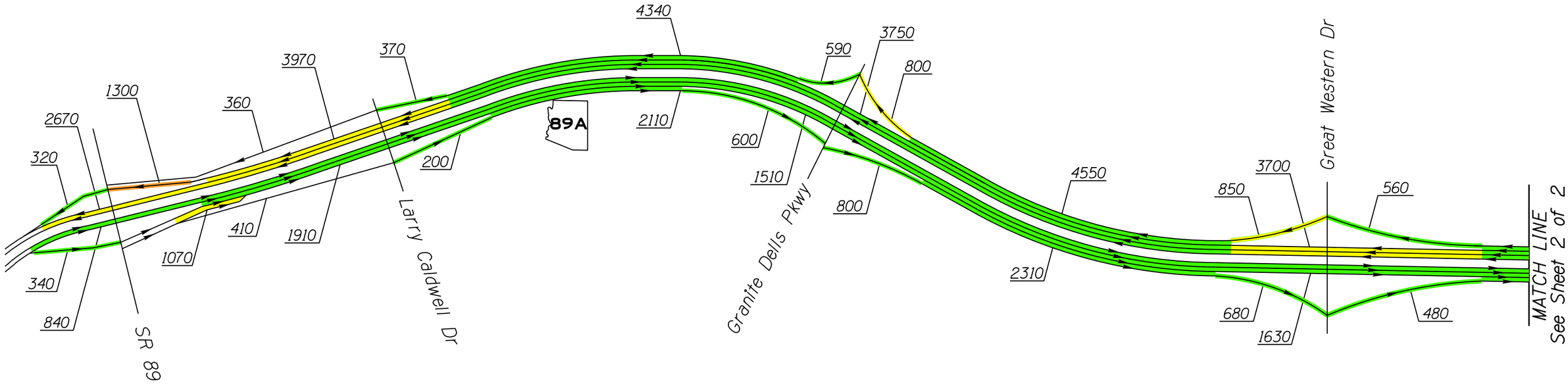
12/5/2017

LEGEND

XXX - 2035 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A 2035 RECOMMENDED
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

12/5/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\Build\SR89A 2035 Build LOS AM.dgn

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\Build\SR89A 2035 Build_LOS AM 2.dgn

12/5/2017

LEGEND

XXX - 2035 AM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

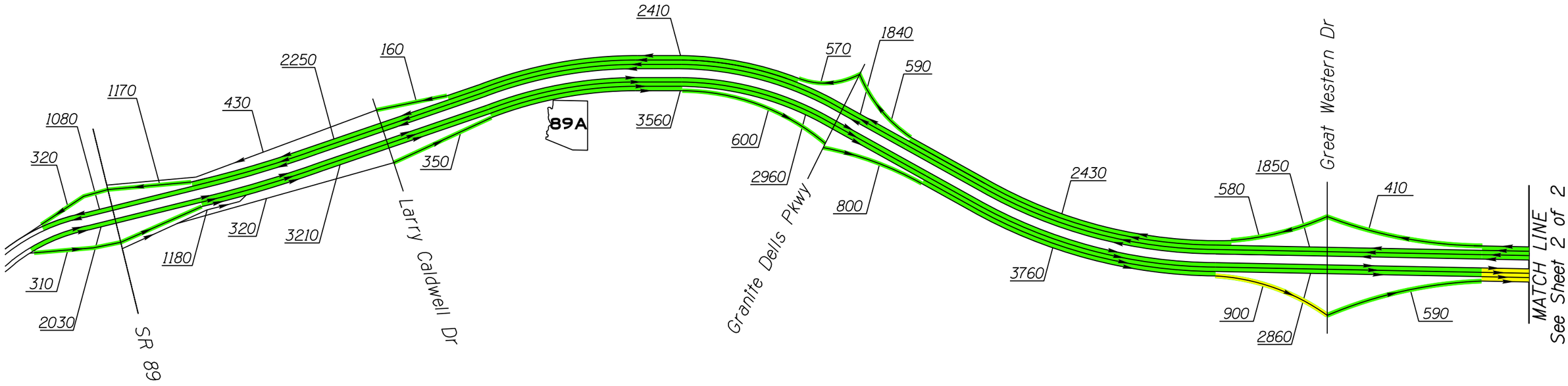
SR 89A 2035 RECOMMENDED
AM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

LEGEND

XXX - 2035 PM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F



SR 89A 2035 RECOMMENDED
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 1 OF 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

12/5/2017 P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\Build\SR89A 2035 Build_LOS PM.dgn

LEGEND

XXX - 2035 PM Peak Hour Volumes

LEVEL OF SERVICE

A	B	C	D	E	F

N

SR 89A

1290

250

1040

800

1840

1360

480

900

2260

MATCH LINE
See Sheet 1 of 2

3450

1150

Glassford Hill Rd

2300

750

3050

89A

1570

N Viewpoint Dr

1480

230

1710

Fain Rd

Robert Rd

SR 89A 2035 RECOMMENDED
PM Peak Hour
LEVEL-OF-SERVICE
SHEET 2 OF 2

SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY

12/5/2017

P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\Build\SR89A 2035 Build_LOS PM 2.dgn

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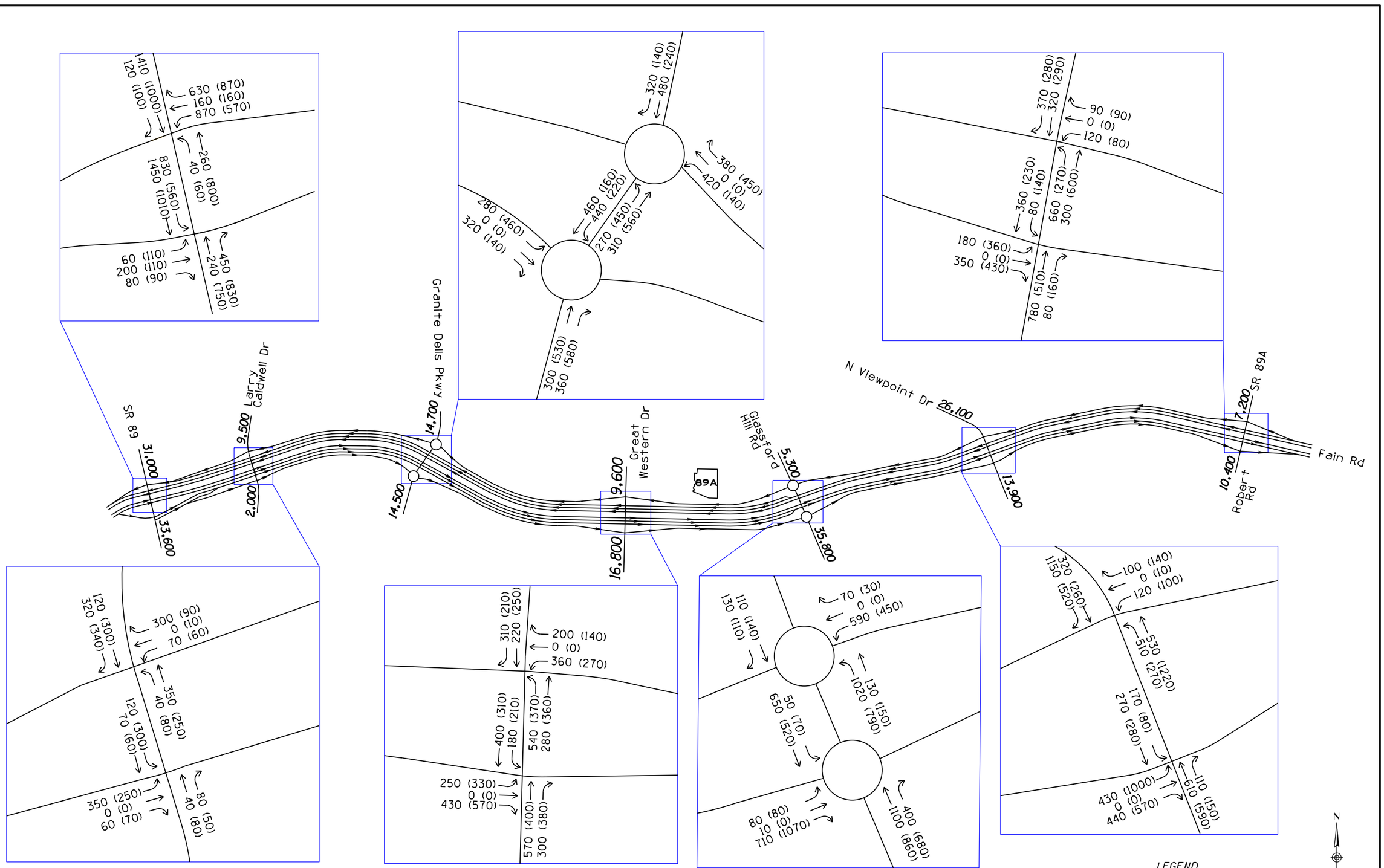
12/5/2017

2035 Recommended
SR 89A (SR 89 To Fain Rd)

NOT TO SCALE - SCHEMATIC ONLY



LEGEND

XXX (XXX) - 2035 AM (PM) Peak Hour Volumes

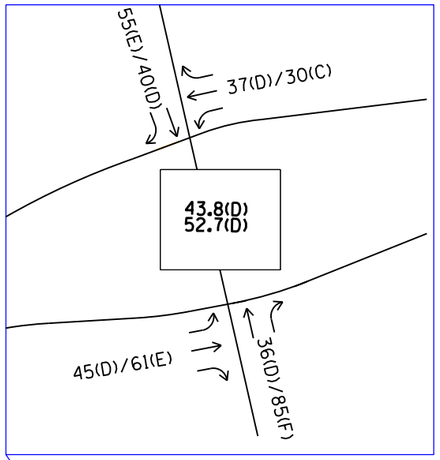
XXXX - 2035 Average Daily Traffic

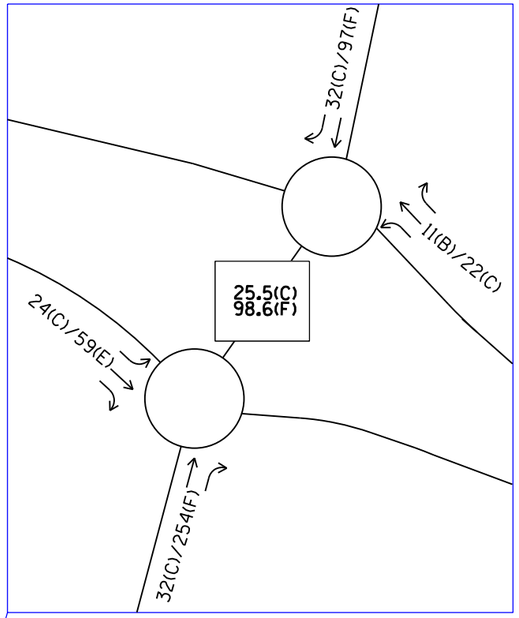
P:\Projects\ADOT\ADOT_TPD\60542112 SR 89A SR 89 to Robert Rd Trans Study\900-CAD GIS\910 CAD\25 SKETCHES\2035\Build\SR89A 2035 Build.LOS Diagram.dgn

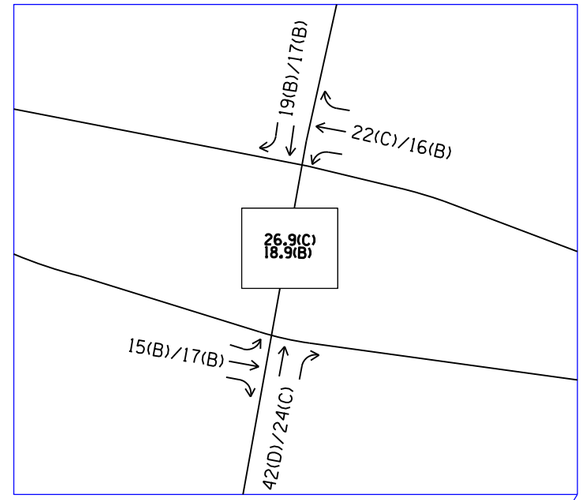
12/5/2017

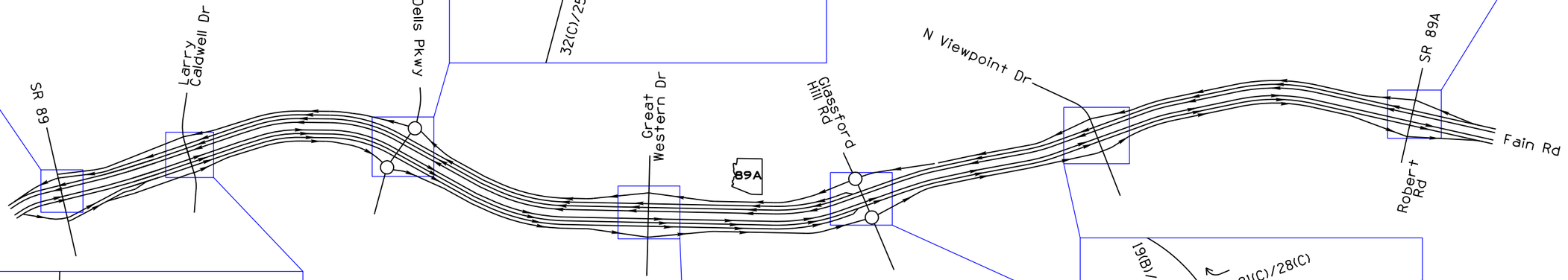
2035 Recommended
SR 89A (SR 89 To Fain Rd)

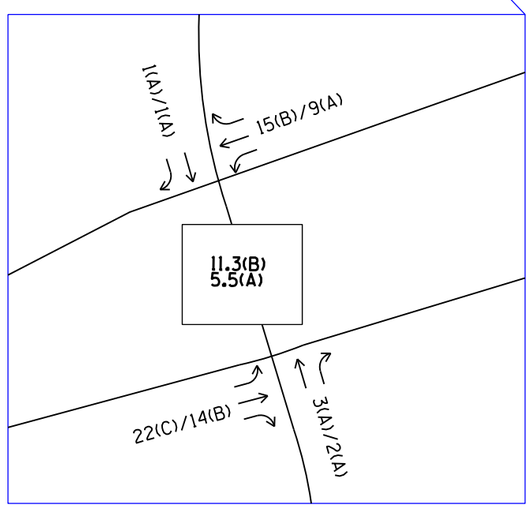
NOT TO SCALE - SCHEMATIC ONLY

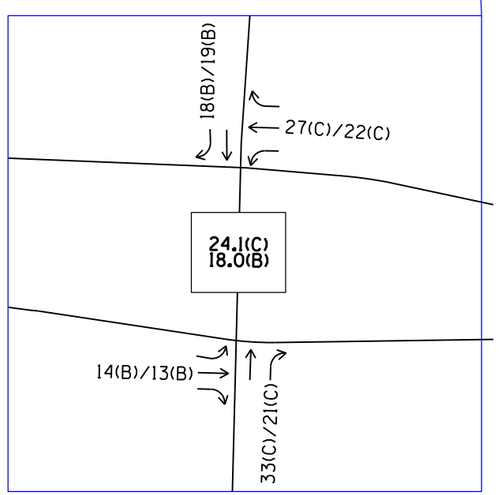


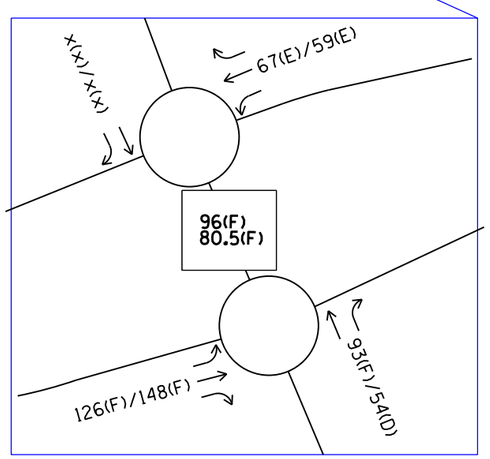


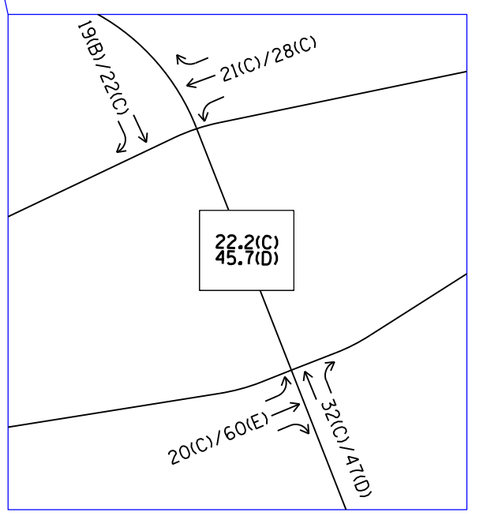












LEGEND

XXX (X)/XXX (X) - 2035 AM Delay (LOS)/PM Delay (LOS)
XXXX (X) *- 2035 AM Total Intersection Delay (LOS)*
XXXX (X) *- 2035 PM Total Intersection Delay (LOS)*